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FINAL
INTERIM REMEDIAL ACTION WORK PLAN
FOR UST SITE 1441
MCB CAMP PENDLETON, CALIFORNIA
Revision 1
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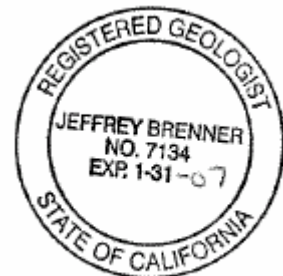


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ABBREVIATIONS AND ACRONYMS

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
bgs	below ground surface
CTO	Contract Task Order
cu yds	cubic yards
DEH	Department of Environmental Health
DOT	U.S. Department of Transportation
DTSC	Department of Toxic Substances Control
FWENC	Foster Wheeler Environmental Corporation
MCB	Marine Corps Base
MCL	Maximum Contamination Limit
mg/kg	milligrams per kilogram
MTBE	methyl tert-butyl ether
NAVFAC SW	Naval Facilities Engineering Command, Southwest
PAH	polynuclear aromatic hydrocarbon
Plan	Interim Remedial Action Work Plan
PPE	personal protective equipment
RCRA	Resource Conservation and Recovery Act
ROICC	Resident Officer in Charge of Construction
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SHSP	Site-Specific Health and Safety Plan
SPLP	Synthetic Precipitation Leaching Procedure
TPH-d	total petroleum hydrocarbons quantified as diesel
TPH-g	total petroleum hydrocarbons quantified as gasoline
TPH-jf	total petroleum hydrocarbons quantified as jet fuel
TPH-mo	total petroleum hydrocarbons quantified as motor oil
UST	Underground Storage Tank
VOC	volatile organic compound
WQO	water quality objective

1.0 INTRODUCTION

This Interim Remedial Action Work Plan (Plan) describes groundwater monitoring well destruction, soil excavation, monitoring well installation, and groundwater sampling activities at Underground Storage Tank (UST) Site 1441, located in the 14 Area of Marine Corps Base (MCB) Camp Pendleton, California (Figure 1-1). The site contained an underground storage tank used to store diesel that leaked and impacted both soil and groundwater. The work is being proposed based on comments received from the Regional Water Quality Control Board (RWQCB) in a letter dated June 10, 2004 (reference: SMC:50-3424.05:grifb) and discussions held during a meeting with the RWQCB on June 1, 2005. This Plan was prepared by SES-TECH, a joint venture between Sealaska Environmental Services LLC and Tetra Tech EC, under the Naval Facilities Engineering Command, Southwest (NAVFAC SW) Environmental Remediation Contract No. N68711-04-D-1104, Contract Task Order (CTO) No. 0003.

This Plan was prepared to meet the applicable requirements as specified in the *San Diego County Site Assessment and Mitigation Manual 2005* [San Diego County Department of Environmental Health (DEH), 2005] and includes a site-specific Sampling and Analysis Plan (SAP) as Appendix A.

NAVFAC and MCB Camp Pendleton are responsible for directing the proposed work and, per NAVFAC directives, SES-TECH is responsible for completing the work. The RWQCB, San Diego Region, is the lead regulatory agency overseeing site activities.

1.1 SITE IDENTIFICATION

Site Address:	Building 1441, 14 Area, MCB Camp Pendleton, California 92055
Facility:	Office Building, 1 st Human Intelligence Unit
RWQCB Case No.:	9UT3424
DEH Case No.:	H05939-306
Property Owner:	United States Marine Corps
MCB Camp Pendleton Contact:	Mr. Chet Storrs Assistant Chief of Staff, Environmental Security Building 22165 MCB Camp Pendleton, CA 92055-5008 (760) 725-9774

**Remedial Project
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Responsible Party:

United States Marine Corps

1.2 PROJECT OBJECTIVES

The primary objectives of this Plan are as follows:

- Describe the site and summarize the findings of previous activities.
- Describe the procedures to destroy existing groundwater monitoring wells prior to soil excavation activities, and describe the procedures to install new monitoring wells after soil excavation activities.
- Describe the procedures for excavating diesel-impacted soil from the former tank cavity area.
- Describe the procedures to complete one year of quarterly groundwater sampling to evaluate potential trends in contaminant levels over time and collect data to be used to evaluate potential natural attenuation processes.

1.3 PLAN ORGANIZATION

This Plan is organized as follows:

- **Section 1.0** – Introduction
- **Section 2.0** – Physical Setting and Previous Investigations (provides a brief description of the site, local geology and hydrogeology, and a summary of previous site activities).
- **Section 3.0** – Groundwater Monitoring Well Destruction, Installation, and Sampling (describes the scope of the proposed field activities related to the monitoring well network at the site, including permitting, drilling, sampling, surveying, etc.)
- **Section 4.0** – Soil Excavation (describes the proposed field activities related to soil excavation)
- **Section 5.0** – Excavation and Construction Management (describes the pre-construction, construction, and post-construction management activities for the soil excavation).
- **Section 6.0** – Waste Management (describes waste management requirements for the project)
- **Section 7.0** – Project Management (describes project scheduling, responsibilities, and contacts).
- **Section 8.0** – References
- **Appendix A** – Sampling and Analysis Plan (SAP)

The SAP (Appendix A) describes field sampling procedures, quality assurance and quality control requirements, and data gathering methods that will be used to support proposed remedial activities. A separate *Site-Specific Health and Safety Plan* (SHSP) (SES-TECH, 2004) has been prepared to support not only the health and safety procedures associated with the proposed field activities at Site 1441, but all field activities associated with CTO No. 0003.

2.0 PHYSICAL SETTING AND PREVIOUS INVESTIGATIONS

The following sections provide a brief description of the site, local geology and hydrogeology, and a summary of previous site activities.

2.1 SITE DESCRIPTION

Site 1441 is located within the 14 Area of MCB Camp Pendleton on 15th Street, approximately 700 feet southeast of the 15th Street and 16th Street intersection (Figure 2-1). Building 1441 rests on stanchions approximately 2 to 4 feet above the ground surface and currently functions as an office building housing the 1st Human Intelligence Unit. The site previously contained a 1,000-gallon, reinforced concrete UST used for storage of diesel fuel used to heat the building. The tank was 7 feet in height (extending 12 inches aboveground) and 6 feet in diameter.

The site is relatively flat, and has asphalt driveways on the north, west, and south sides of Building 1441, and a parking area located on the west side of the building. The site is located on the western edge of Pilgrim Creek Canyon with approximately 70 feet of vertical relief to the creek below on the northern and eastern sides of the site.

2.2 GEOLOGY AND HYDROGEOLOGY

The geology at Site 1441 primarily consists of fine- to medium-grained sands overlying weathered granodiorite and competent granodiorite bedrock. The sands are part of the Middle-Eocene Santiago Formation of the La Jolla Group. The weathered granodiorite and granodioritic bedrock are encountered beneath the site approximately 5 to 10 feet below ground surface (bgs).

According to the *Water Quality Control Plan for the San Diego Basin* (RWQCB, 1994), Site 1441 is located within the Mission Hydrologic Subarea of the Lower San Luis Hydrologic Area within the San Luis Rey Hydrologic Unit. Groundwater in this area has designated beneficial uses including municipal and domestic supply, agricultural supply, industrial process supply, and industrial service supply. However, no groundwater supply wells are located within approximately 2 miles of the site.

The site is located approximately 500 feet to the west of Pilgrim Creek, which is a tributary to the San Luis Rey River. Surface water from Pilgrim Creek has been designated by the RWQCB to have beneficial uses for agricultural supply, industrial service supply, contact water recreation, non-contact water recreation, warm freshwater habitat, and wildlife habitat.

During the most recent groundwater monitoring event completed at the site in June 2003 (FWENC, 2003), groundwater was first encountered between approximately 5 and 18 feet bgs. Water-level data collected from the site indicated that groundwater flowed to the southwest with

an approximate hydraulic gradient of 0.3 feet per foot (FWENC, 2003). During June 2003 free product was not observed in any well.

2.3 UST REMOVAL

In 1997 the 1,000 gallon diesel UST was removed from the site. The excavation was 12 feet by 11 feet and approximately 7 feet deep. A Hazardous Materials Specialist from the DEH directed soil sampling activities and two soil samples were collected from beneath the tank cavity and one was collected from where the pipeline entered the building. Samples were analyzed for total petroleum hydrocarbons quantified as gasoline (TPH-g), and total petroleum hydrocarbons quantified as diesel (TPH-d). TPH-g was not detected, but TPH-d was detected at 3,800 and 8,100 milligrams per kilogram (mg/kg) in the samples beneath the tank, and at 9,300 mg/kg in the sample from beneath the pipeline. The locations of the samples and analytical results are shown on Figure 2-2.

Following the tank excavation, the area was backfilled with the excavated soil and with clean fill to replace the void created by removing the tank.

2.4 SITE ASSESSMENT

In September 1998 a site assessment was completed consisting of eight soil borings (SB01 to SB08) (Battelle, 1999). The soil borings were located around the former UST and pipeline where hydrocarbons had been detected during tank removal activities (Figure 2-2).

The initial boring (SB01) was continuously cored in the former tank cavity for lithologic characterization to a depth of 8 feet bgs, at which point the core barrel was refused by bedrock and groundwater was encountered. The boring was further advanced to a total depth of 15 feet with an air rotary drilling rig (SB01A). Boring SB02 was located near the southeast corner of the building to investigate the area surrounding the former remote fill location and was hand augered to 6.5 feet bgs. The remaining soil borings (SB03 through SB08) were advanced to depths ranging from 50 to 60 feet bgs around the former tank cavity using an air rotary drilling rig. Saturated sediments and/or moist bedrock were detected during drilling in each soil boring except SB05, which was angle drilled to the northeast under the building. Soil samples were typically collected every 5-feet during drilling, and six permanent groundwater monitoring wells were subsequently installed.

All soil and groundwater samples were analyzed for TPH-d, TPH quantified as jet fuel (TPH-jf), and as motor oil (TPH-mo), and, based on visual inspection of the soil cuttings, specific soil samples were also analyzed for volatile organic compounds (VOCs) and polynuclear aromatic hydrocarbons (PAHs). All groundwater samples were also analyzed for VOCs and PAHs. Synthetic Precipitation Leaching Procedure (SPLP) tests were performed on two soil samples

with relatively high TPH-d concentrations, and on one soil sample with the lowest TPH-d concentration above 100 mg/kg.

The initial boring (SB01), drilled to 15 feet bgs, encountered wet sands between 7 and 8 feet bgs, and the top of a weathered granodioritic bedrock at 9 feet bgs. The groundwater was believed to be water that had accumulated in the former UST excavation and was being perched by the underlying bedrock. Drilling of the other borings indicated that groundwater was present in two zones. The first, or shallow zone, was near the former UST excavation perched above the shallow bedrock. The second, or deeper zone, occurred at various depths between approximately 10 and 35 feet bgs within the weathered and fractured bedrock in each boring. Upon completion of the monitoring wells, infiltrating water entering by what appeared to be relatively slow seepage from the fractured granodioritic bedrock that filled the borings to varying depths ranging from 14 to 22 feet bgs.

Free product was observed in several borings prior to the installation of monitoring wells. Free product was observed in borings SB03 (0.05 feet), SB04 (0.09 feet), SB06 (0.26 feet), SB07 (0.14 feet), and SB08 (0.26 feet). Following the installation of the groundwater monitoring wells, but prior to well development, free product was only observed in MW01 (SB08) at 0.02 feet. After well development, and immediately prior to sampling on October 28, 1998, free product was observed in well MW02 (SB04) at a thickness of 0.15 feet, and a sheen was observed in well MW01. Table 2-1 provides a summary of the water level and free-product data measured during sampling.

Figures 2-3 and 2-4 presents the results for soil samples analyzed during the site assessment. Based on the results, it was concluded the majority of the soil contamination was located in the vadose zone surrounding the former tank area. However, contamination was also reported as deep as 45 feet bgs (SB03), where TPH-d was detected at 170 mg/kg. The highest TPH-d concentration detected in the soil, 2,400 mg/kg, was observed in SB03 at 30 feet bgs (Figure 2-3). Soil contamination was reported to extend from the former tank cavity to SB06, located approximately 42 feet away. Thirteen VOCs and four PAH compounds were also detected, with the highest concentrations measured at 2,600 micrograms per kilogram ($\mu\text{g/kg}$) for 1,2,4-trimethylbenzene, and 3,100 $\mu\text{g/kg}$ for phenanthrene (Figure 2-4).

SPLP analyses were performed on two soil samples with relatively high TPH-d concentrations (SB01-GRAB-08' with 2,300 mg/kg TPH-d, and SB06-14' with 2,100 mg/kg TPH-d), and on one soil sample with the lowest measured TPH concentration above 100 mg/kg (SB07-50' with 110 mg/kg TPH-d). SPLP test results indicated that ten VOCs were present in the leachate ranging from 0.59 micrograms per liter ($\mu\text{g/L}$) (o-xylene) to 5.1 $\mu\text{g/L}$ (1,3,5-trimethylbenzene) (Battelle, 1999). PAHs were not detected in any of the samples.

Figure 2-5 illustrates the location of monitoring wells MW01, MW01A, MW02, MW03, MW04, and MW05 in relation to the former UST and Building 1441. Groundwater samples collected during the site assessment indicated that TPH-d was present in each well at concentrations ranging from 3.8 to 13 mg/L. In addition, seventeen VOCs were detected in the wells with concentrations ranging from 1.0 µg/L bromodichloromethane to 120 µg/L naphthalene. Included in the group of detected VOCs was benzene, which was detected in MW01, MW02, MW03, MW04, and MW05 at concentrations of 6.0, 22, 2.7, 0.75, and 5.6 µg/L, respectively. In addition, trichloroethene was detected in MW02 at 1.3 µg/L, and methyl tert-butyl ether (MTBE) was detected in MW02 at 0.57 µg/L and in MW04 at 1.5 µg/L. Naphthalene was the only PAH observed in the groundwater samples and was detected in MW01A and MW02 at 34 and 43 µg/L, respectively. Figure 2-5 illustrates the water sample results in relation to the sampling locations.

2.5 QUARTERLY GROUNDWATER SAMPLING

After collecting groundwater samples during the site assessment in 1998, four additional quarterly sampling events were completed between November 2000 and July 2001 (Battelle, 2001). The sampling events were completed in November 2000, January 2001, April 2001, and July 2001.

An oil-water interface probe was used to monitor the depth to groundwater and to check for the presence of free product in each well during each event. In MW05, free product was measured in November 2000 and January 2001 at 0.15 ft and 1.18 ft, respectively. All site wells were sampled each quarter except for MW05 in November 2000 and January 2001, when free product was present.

Water-level data collected from monitoring wells MW02, MW03, and MW04 were used to determine groundwater flow direction and hydraulic gradient. Based on the water levels collected during the last sampling event (July 2001), groundwater flowed to the southwest with an average gradient of 0.2. This is consistent with groundwater flow directions calculated during the other events. Water levels measured during the four quarterly events are presented on Table 2-1.

During the four sampling events groundwater samples were analyzed for TPH-d, TPH-jf, TPH-mo, and VOCs. Groundwater samples collected during the last (July 2001) sampling event indicated the presence of TPH-d in all wells. Concentrations of TPH-d ranged from 0.51 to 43 mg/L, with the highest concentration measured in well MW05. Benzene was measured in MW01, MW01A, MW02, and MW05 at concentrations of 3.6 µg/L, 0.32 µg/L, 0.78 µg/L, and 2.7 µg/L, respectively. Ethylbenzene was detected in MW01, MW01A, and MW02 at concentrations of 6.1 µg/L, 8.7 µg/L, and 3.7 µg/L, respectively. Xylenes were measured in MW01, MW01A, and MW05 at concentrations of 0.70 µg/L, 0.57 µg/L, and 10.7 µg/L, respectively. Naphthalene was measured in MW01, MW01A, MW02, and MW05 at

concentrations of 30 µg/L, 62 µg/L, 19 µg/L, and 18 µg/L, respectively. MTBE was detected in MW01 and MW01A at concentrations of 1.8 µg/L and 0.50 µg/L, respectively. No VOCs were detected in wells MW03 and MW04. All other VOCs detected at Site 1441 were either below their respective MCLs, or no MCL existed for the compound. The analytical results for each of the four sampling events is summarized on Figure 2-6.

Overall, for each of the four quarterly sampling events, TPH-d was detected in all wells sampled at concentrations that exceeded the secondary taste and odor water quality threshold value of 0.1 mg/L. In addition, benzene concentrations measured in MW01 and MW05 exceeded the MCL for benzene (1 µg/L) during each event. However, MW05 was not sampled during the November 2000 and January 2001 event due to the presence of free product. All other petroleum hydrocarbon compounds detected at Site 1441 were either below their respective MCLs, or no MCL exists for the compound.

2.6 ADDITIONAL GROUNDWATER SAMPLING

In June 2003 an additional groundwater sampling event was conducted at Site 1441 to determine if Comprehensive Environmental Response, Compensation, and Liability Act constituents were present in groundwater [Foster Wheeler Environmental Corp. (FWENC), 2003].

Using low-flow groundwater sampling techniques all six wells at the site were sampled for TPH-d, TPH-jf, TPH-mo, VOCs, and total lead. Groundwater elevation data collected in June 2003 (Table 2-1) indicated that groundwater flowed to the southwest with a gradient of approximately 0.3 feet per foot (Figure 2-7). Free product was not observed in any well.

As summarized on Table 2-2, analytical results indicated that TPH-d and TPH-jf were present in all six wells at concentrations between 0.90 mg/L and 15 mg/L. Trichloroethene was detected in MW01 at an estimated value of 0.54 µg/L. Benzene, the only VOC present above its Maximum Contaminant Level (MCL) (1.0 µg/L), was present in MW01 and MW05 at 2.1 µg/L and 1.2 µg/L, respectively. A variety of other VOCs were reported but at low to estimated values (Table 2-2). Lead was only detected at estimated values in wells MW01A and MW02.

2.7 NATURE AND EXTENT OF CONTAMINATION

Data from site investigation activities indicate that both soil and groundwater have been impacted with petroleum hydrocarbons. Brief descriptions of these impacts are summarized below.

2.7.1 Soil

Laboratory results from soil samples collected during site assessment activities suggest that the majority of soil contamination is located in the vadose zone surrounding the former tank area. Contamination was also reported as deep as 45 feet bgs (SB03), where TPH-d was detected at

170 mg/kg. The highest TPH-d concentration detected in soil (2,400 mg/kg) was observed in SB03, located adjacent to the former tank cavity, at 30 feet bgs (Figure 2-3). Soil contamination was reported to extend from the former tank cavity to SB06, located approximately 42 feet away. Thirteen VOCs and four PAH compounds were also detected, with the highest concentrations measured at 2,600 µg/kg for 1,2,4-trimethylbenzene, and 3,100 µg/kg for phenanthrene (Figure 2-4). The estimated dimensions of the most impacted soil in the vadose zone beneath and near the former tank cavity include an area approximately 15 feet by 40 feet, extending from the former tank cavity to the south, and extending down to approximately 10 feet bgs. The estimated volume of the most impacted soils in the vadose zone is approximately 225 cubic yards (cu yds).

2.7.2 Groundwater

Analytical data collected during the most recent groundwater sampling event (June 2003) indicated that TPH-d was present in all six monitoring wells at concentrations between 0.90 mg/L and 15 mg/L. Benzene, the only VOC present above its MCL (1.0 µg/L), was present in MW01 and MW05 at 2.1 µg/L and 1.2 µg/L, respectively. A variety of other VOCs were reported but at low to estimated values (Table 2-2). Free product was not observed in any well.

3.0 GROUNDWATER MONITORING WELL DESTRUCTION, INSTALLATION, AND SAMPLING

The following sections describe the procedures for the destruction of existing monitoring wells before soil excavation begins, the installation of new wells after the soil excavation is complete, and the completion of four quarterly rounds of groundwater sampling. The soil excavation procedures are described in Section 4.0.

3.1 UNDERGROUND UTILITY SURVEY AND UTILITY REROUTE

Prior to any subsurface work a geophysical survey will be conducted using ground-penetrating radar and/or electromagnetic induction instruments, as necessary, to identify underground utilities and discontinuities in the soil column. These anomalies will be compared to available as-built drawings to provide confirmation of the Base Utility Locator Service and Underground Service Alert regarding the locations of underground utilities. The surface over areas of suspected underground utilities will be marked with appropriately colored paints. If an underground utility is in the area of proposed drilling (or soil excavation), it will be rerouted, either temporarily or permanently, at the direction and oversight of the MCB Camp Pendleton Resident Officer in Charge of Construction (ROICC).

In addition to underground utilities, several overhead utilities are present near the area of proposed drilling (and soil excavation). If any overhead utilities, such as electrical or communication lines, can potentially interfere with the safe execution of work, they will be rerouted, either temporarily or permanently, at the direction and oversight of the MCB Camp Pendleton ROICC.

Prior to any field activity the nearest shut-off valves for all utilities that may be encountered will be identified and access to those shut-off valves will be ensured during all field activities.

3.2 MONITORING WELL DESTRUCTION

Prior to beginning soil excavation activities the groundwater monitoring wells that are either in the area of proposed excavation (MW01, MW01A, MW02), or have screened intervals below groundwater (MW03 and potentially MW04 and MW05) will be destroyed after obtaining the appropriate permit. Water levels will be measured prior to well destruction to determine if MW04 and/or MW05 will be destroyed. The wells extend between approximately 15 to 38 feet bgs and are constructed with 4-inch-diameter polyvinyl chloride casing and screen. After removing the surface completions with a jackhammer, each well will be over-drilled with a hollow-stem auger. All casing and annular backfill materials will be removed and stored in 55-gallon drums or stockpiled with excavated soil for subsequent transportation to an appropriate

disposal facility. The borings will be backfilled with bentonite pellets or equivalent from total depth to the ground surface.

3.3 MONITORING WELL CONSTRUCTION

To replace the groundwater monitoring well network that was destroyed before the soil excavation began, three to four new monitoring wells will be installed after the soil excavation is complete. If all of the previously installed wells are destroyed, four new wells will be installed. If at least one of the previous wells is not destroyed, three new wells will be installed. After obtaining the appropriate well permit, one new groundwater monitoring well (MW06) will be installed in the former tank cavity, and the remaining new wells (MW07, MW08, and possibly MW09) will be installed in downgradient locations as shown on Figure 3-1.

Drilling will be performed with an air rotary, or equivalent, drill rig due to the hard granodiorite bedrock present beneath the site. The wells will be installed in accordance with guidance provided in Appendix B of the SAM Manual (DEH, 2005) to between approximately 20 and 35 feet bgs depending on where groundwater is encountered in the fractured bedrock. The final well depths will be determined in the field at the time of drilling such that the well screen will be located across the water table.

The wells will be constructed with 15 feet of 4-inch diameter Schedule 40, polyvinyl chloride screen (0.010-inch slots), and blank casing. All sections of the well casing, including the screened section, will be cleaned before use. The annular space between the screen and the boring wall will be backfilled from the bottom of the casing to at least 2 feet above the top of the screen with a clean, graded Lonestar[®] No. 2-16 sand, or equivalent. A seal, at least 2 to 3 feet thick, comprised of bentonite pellets, will be placed on top of the sand. A tape measure with an attached weight will be used to continuously monitor the progress of the backfilling procedures.

3.4 MONITORING WELL DEVELOPMENT

The new monitoring wells will be developed after construction to clear the well screens and filter-packs of fine materials that could possibly clog the screen slots and reduce the effectiveness of the screens. The wells will be developed by surging, bailing, and pumping.

3.5 TOPOGRAPHIC SURVEY

After construction of the new groundwater monitoring wells, a topographic survey will be performed to delineate the location and elevation of each new well. Measurements will be to an accuracy of 0.1 foot horizontally and 0.01 foot vertically and will be in accordance with North American Datum 83 and North American Vertical Datum 88 (mean sea level), respectively. A report will be generated by the survey subcontractor and will be signed by a State of California-registered professional surveyor.

3.6 GROUNDWATER SAMPLING

After the new monitoring wells are installed, a one-year quarterly groundwater sampling program will begin.

The depth to water, and free product, if present, will be measured in each well and recorded on well sampling logs before groundwater samples are collected. The depths will be measured from the top of the casing in each well.

Samples will be collected from all wells with the water table across the screened interval using low-flow sampling techniques in accordance with guidance provided in the *San Diego County Site Assessment and Mitigation Manual 2005* (SAM Manual) (DEH, 2005).

Prior to groundwater sampling, each well will be purged using a bladder pump placed within the screened portion of the well and located at the approximate mid-point of the water column. A water level probe will be lowered to the water table surface to monitor drawdown, which will be kept to a minimum due to the low-flow pumping rates. For each well, the flow rate, which will not exceed 1-liter per minute, will be adjusted to obtain a stabilized water level. To ensure the collection of a representative groundwater sample, the temperature, pH, electrical conductivity, turbidity, dissolved oxygen, and oxidation/reduction potential will be monitored. These measurements will be recorded on the well sampling logs. Each well will be considered purged once the water quality parameters have stabilized (when the difference between successive measurements is less than 10 percent).

Groundwater samples will be collected through dedicated discharge tubing, which will be connected to the bladder pump. Each sample collected will be placed in the appropriate containers, labeled, and placed in a cooler with ice immediately following sample collection for delivery to an analytical laboratory.

All non-disposable sampling equipment such as the bladder pump and water-level meter will be thoroughly decontaminated prior to sample collection at each well location.

3.6.1 Sample Analysis

Groundwater samples will be analyzed for TPH-d, VOCs, PAHs, and natural attenuation parameters (nitrate, sulfate, and ferrous iron) according to the procedures outlined in the SAP (Appendix A).

4.0 SOIL EXCAVATION

Diesel impacted soil located beneath and near the former tank cavity will be excavated. The following sections describe soil excavation activities.

4.1 UNDERGROUND UTILITY SURVEY AND UTILITY REROUTE

The geophysical survey to be completed for the new well installation will include both the proposed soil excavation area and the groundwater monitoring well installation sites. This survey, along with the overhead and belowground utility location and potential rerouting procedures is discussed in Section 3.1.

4.2 PROPOSED CLEANUP GOALS

Cleanup goals for contaminated soils are established so that residual soil does not have the potential to leach contaminants into groundwater at levels above drinking water MCLs and/or water quality objectives (WQOs) (RWQCB, 1994). The proposed cleanup goals for diesel constituents are summarized in Table 4-1.

4.3 SOIL EXCAVATION

An excavator will be used to excavate diesel-impacted soils from the former tank cavity area. The excavation will extend laterally approximately 15 feet by 40 feet (Figure 3-1), and extend vertically to approximately 10 feet bgs, or to the top of the granodiorite bedrock if shallower. The proposed excavation will extend from the tank cavity area to the south, towards MW02 (Figure 3-1), due to the relatively high TPH-d levels reported in shallow soils in that area (940 mg/kg at 5 feet bgs in MW02). A competent certified professional engineer will make an evaluation of the type soils present and determine if shoring will be required to protect nearby Building 1441 and nearby underground utilities during the excavation.

To evaluate if the impacted soils have been successfully removed from the site, confirmation soil samples will be collected. One soil sample will be collected from each 20 feet of excavation sidewall, and two samples will be collected from the excavation bottom. Additional samples may be collected at the discretion of the field geologist based on visual observations or field instrument readings. Each confirmation sample will be analyzed for TPH-d, and the soil sample with the highest TPH-d result will be further analyzed for SPLP/TPH-d, SPLP/VOCs and SPLP/PAHs. Sampling methods and protocols are described in the SAP (Appendix A). In addition, a soil grab sample will be collected from the bottom of the excavation and analyzed for natural attenuation parameters including contaminant-degrading bacterial populations, Total Heterotrophic Plate Count, and general nutrient status (ammonia as nitrogen, nitrate/nitrite as nitrogen, and orthophosphate as phosphorous).

It is estimated that approximately of 225 cubic yards of soil will be removed from the site. The soil stockpile will be constructed on available asphalt or plastic sheets in accordance with RWQCB Resolution 95-96 (RWQCB, 1995). Excavated impacted soil will be sampled for waste characterization purposes, as necessary, prior to transportation to a permitted waste disposal facility. Copies of waste manifests will be provided in a report describing soil excavation activities.

5.0 EXCAVATION AND CONSTRUCTION MANAGEMENT

This section describes the pre-construction, construction, and post-construction management activities for the removal of contaminated soil from UST Site 1441.

5.1 PRE-CONSTRUCTION DISCUSSIONS

Prior to commencing field activities, discussions will be held with the MCB Camp Pendleton ROICC, the Navy Remedial Project Manager, and MCB Camp Pendleton Environmental Security personnel to discuss and develop an understanding of the fieldwork and the associated schedule and logistics.

5.2 FIELD MOBILIZATION

This task will include mobilization of field personnel and equipment to the site. Field personnel will include:

- Site Health and Safety Specialist
- Site Construction Superintendent
- Heavy Equipment Operators
- Laborers

Required equipment includes:

- Excavator
- A front-end loader
- Trucks and/or trailers for material transportation

In addition to the equipment listed above, construction activities may require the use of shovels, picks, sampling trowels, and other similar hand tools.

5.3 SITE PREPARATION

Site preparation activities include:

- Establishing traffic routes with approval from the ROICC for vehicles and heavy equipment
- Implementing health and safety procedures
- Establishing areas for staging of equipment and materials

- Setting up personnel and equipment decontamination facilities
- Establishing other temporary facilities that may include sanitary facilities and parking areas

5.4 DECONTAMINATION FACILITIES

Equipment used to collect soil samples will be decontaminated prior to sampling and in between sample locations pursuant to procedures described in the SAP (Appendix A). A temporary equipment decontamination pad, consisting of a bermed polyethylene liner, will be constructed to facilitate collection of the wastewater, if a self-contained decontamination trailer is not used. The pad will be used for rinsing and decontamination of all equipment that encounters contaminated soil. The rinsate will be collected and placed into temporary storage in United States Department of Transportation (DOT)-approved 55-gallon drums or portable tanks. The wastewater will be analyzed; if necessary, profiled, and transported to an appropriate off-site permitted facility for treatment and/or disposal.

Because of the potential for exposure to contaminated soil, provisions will be made for personnel decontamination. The decontamination process and equipment required are described in the Site-Specific Health and Safety Plan (SHSP) (SES-TECH, 2004). The Site Health and Safety Specialist will be responsible for maintaining compliance with the SHSP.

5.5 DELINEATION OF EXCAVATION AREA

The areas designated for excavation will be clearly delineated by marking paint and/or markers with flags. The location of the soil stockpile will be determined in discussions with the ROICC.

5.6 EXCAVATION OF SOILS

Excavation activities will be completed with an excavator. Due to the close proximity of Building 1441 and various underground utilities, box shoring may be used. The use of shoring will be determined by a competent certified professional engineer. The excavation will extend approximately 15 feet by 40 feet, and approximately 10 feet bgs. A photo-ionization detector will be used as a screening tool on the excavated soil for health and safety purposes.

5.7 SAMPLING AND ANALYSIS

To evaluate the effectiveness of the excavation, a confirmation soil sample will be collected from each 20 feet of sidewall, and two samples will be collected from the bottom of the excavation. Each confirmation sample will be analyzed for TPH-d, and the soil sample with the highest TPH-d result will be further analyzed for SPLP/TPH-d, SPLP/VOCs and SPLP/PAHs. Detailed descriptions of analytical methods and sampling procedures are provided in the SAP (Appendix A). In addition, a soil grab sample will be collected from the bottom of the excavation and analyzed for natural attenuation parameters including contaminant-degrading bacterial

populations, Total Heterotrophic Plate Count, and general nutrient status (ammonia as nitrogen, nitrate/nitrite as nitrogen, and orthophosphate as phosphorous).

5.8 BACKFILL AND COMPACTION

The excavation will be backfilled to 90 percent compaction (using ASTM D1556 or ASTM D2922 methods certified by a licensed soils engineer) with imported fill material obtained from a sand and gravel quarry or from one of the Base's borrow pits. Samples will be collected from each imported material source prior to use as described in the SAP. The California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) *Information Advisory for Clean Imported Fill Material* (DTSC, 2001) will be used as a guidance document to determine the sampling frequency and analysis. All backfill material samples, at a minimum, will be analyzed for Title 22 metals and pH. If the Base's borrow pit is used, samples will also be analyzed for TPH-d. A detailed description of the sampling and analyses of fill materials is included in the SAP (Appendix A).

After backfilling, the ground surface will be restored to match pre-existing grade and conditions. The site restoration will be completed within approximately one week of completion of excavation.

5.9 POST-CONSTRUCTION PHASE

The post-construction phase includes demobilization of equipment and personnel. Temporary facilities installed for use during construction will be removed, and the site will be re-opened for use by the Marine Corps.

6.0 WASTE MANAGEMENT

This section summarizes the handling and disposal methods for the excavated soil, soil cuttings, purged groundwater, and other waste generated during project activities. All wastes will be disposed of within 60 days of start of accumulation.

6.1 PPE AND LIQUIDS DISPOSAL

All used PPE will be stored in trash bags and later disposed of at a proper landfill. Wastewater generated from equipment decontamination and from well purging will be stored in DOT-approved 55-gallon drums or portable storage tanks. All drums and/or tanks will be labeled once accumulation has begun and stored on site away from high-use and high-traffic areas. Wastewater will be sampled and analyzed, as necessary, and transported to an appropriate off-site disposal and/or treatment facility.

6.2 SOIL DISPOSAL

All excavated soil will be stockpiled prior to disposal. Soil cuttings from well destruction/installation activities will be stored in 55-gallon drums or placed on the excavated soil stockpile. Stockpile and drum samples will be collected and analyzed to characterize the waste, as necessary, for disposal purposes only (see SAP, Appendix A). Disposal may be a combination of options determined by the results of analyses and hazardous classifications as follows:

- Although not anticipated to be present, any soil classified as Resource Conservation and Recovery Act (RCRA) hazardous waste will be transported to a licensed treatment, storage, and disposal facility for treatment and disposal.
- Any soil classified as non-RCRA hazardous waste will be transported for disposal to a licensed hazardous waste landfill facility.
- Soil classified as non-hazardous waste will be transported for disposal to a licensed landfill or soil treatment facility permitted to accept the material.

All waste manifests and profiles, along with analytical data, will be routed, once approved by SES-TECH personnel, through the Assistant Chief of Staff/Environmental Security, MCB Camp Pendleton, for signature. Original copies of the manifest packages will be provided to the transporter for shipment. All wastes will be transported via a licensed transporter approved by SES-TECH.

7.0 PROJECT MANAGEMENT

The following section discusses the project scheduling, responsibilities, and contacts.

7.1 PROJECT SCHEDULE

Three primary activities will be completed during the course of this project:

1. **Field Preparation Activities.** This includes obtaining well destruction/installation permits, procurement of subcontractors, and Navy and MCB Camp Pendleton notification. Field preparation activities are estimated to take 4 weeks.
2. **Field Activities.** This includes completing the underground utility survey, destroying existing wells, rerouting utilities if necessary, excavating impacted soils, backfilling the excavation, installing and developing new groundwater monitoring wells, surveying the new well locations, and the first groundwater sampling event. The initial field activities are estimated to take 4 weeks. It will require another 3 quarters (9 months) after the soil excavation is finished to complete the remaining three groundwater sampling events.
3. **Reporting.** Quarterly groundwater sampling reports will be prepared after each quarterly sampling event, and a Corrective Action Plan will be prepared after the one year of groundwater sampling is completed presenting the results of the soil excavation. The Corrective Action Plan will include a screening and evaluation process for identifying the most appropriate remedial alternatives, if required, for the site.

7.2 PROJECT RESPONSIBILITIES

The Navy Remedial Project Manager for this project is Mr. Bipin Patel. Mr. Patel is responsible for overall project management, budget control, and schedule maintenance. Mr. Chet Storrs of the MCB Camp Pendleton Remediation Branch, will be the primary point of contact at MCB Camp Pendleton. Mr. Storrs will review all project documents and be the regulatory agency contact. Mr. Any Brochu is the MCB Camp Pendleton ROICC and is responsible for oversight and quality control of the field activities. Mr. Narciso Ancog is the Navy Quality Assurance Officer and will oversee project quality control.

SES-TECH's Project Manager is Mr. Mark Cutler, who will be responsible for general project administration and performance.

7.3 LIST OF POINTS OF CONTACT

The following is a list of names and telephone numbers for Navy, MCB Camp Pendleton, and SES-TECH personnel involved with the project.

Agency	Contact	Project Title
Naval Facilities Engineering Command Southwest Division 1220 Pacific Highway San Diego, CA 92132-5190	Mr. Bipin Patel (619) 532-4814 Fax (619) 532-4160	Remedial Project Manager
MCB Camp Pendleton AC/S Environmental Security Office Building 22165 Camp Pendleton, CA 92055-5008	Mr. Chet Storrs (760) 725-9774 Fax (760) 725-9746	Remediation Branch, MCB Camp Pendleton
MCB Camp Pendleton ROICC Office Building 22101 Camp Pendleton, CA 92055-5229	Mr. Andy Brochu (760) 470-4396 (cell) Fax (760) 725-8210	ROICC
Naval Facilities Engineering Command Southwest Division 1220 Pacific Highway San Diego, CA 92132-5190	Mr. Narciso Ancog (619) 532-3046	Navy Quality Assurance Officer
SES-TECH 1940 E. Deere Avenue, Suite 200 Santa Ana, CA 92705	Mr. Mark Cutler (949) 756-7526	Project Manager
SES-TECH 1940 E. Deere Avenue, Suite 200 Santa Ana, CA 92705	Ms. Tania Turpijn-Keasler (949) 212-0681 (cell)	Site Manager

8.0 REFERENCES

- Battelle Memorial Institute (Battelle), 1999. *Final Site Assessment Report for Former Underground Storage Tank Site 1441 at Marine Corps Base Camp Pendleton, Oceanside, California*. July.
- Battelle Memorial Institute (Battelle), 2001. *Summary Groundwater Monitoring Report, Site 1441, Marine Corps Base Camp Pendleton*. October.
- Department of Toxic Substances (DTSC). 2001. *Information Advisory for Clean Imported Fill Material*. October.
- Foster Wheeler Environmental Corporation (FWENC), 2003. *Final Report on Low-Flow Groundwater Sampling for UST Sites 1441, 1536, 1655, 1791, 2666, 14127, and 16103, MCB Camp Pendleton, Revision 1*. August.
- Regional Water Quality Control Board (RWQCB). 1994. *Water Quality Control Plan for the San Diego Basin (Basin Plan) 1994 (Amended)*.
- _____. 1995. *Resolution 95-96: A Resolution Conditionally Waiving Adoption of Waste Discharge Requirements for Temporary Discharge of Contaminated Soils to Waste Piles (Stockpiles)*.
- San Diego County Department of Environmental Health (DEH), Land and Water Quality Division. 2005. *San Diego County Site Assessment and Mitigation Manual, 2005*.
- SES-TECH. 2004. *Final Site-Specific Health and Safety Plan, Revision 0. Remediation of USTs in Areas 43, 21, 14, and 11, Marine Corps Base Camp Pendleton, California*. May.

TABLES

TABLE 2-1
HISTORICAL GROUNDWATER AND
FREE PRODUCT LEVEL MEASUREMENTS, UST SITE 1441

Number Well	Date Measured	Top of Casing Elevation (ft amsl)	Screen Interval (ft btoc)	Water Level (ft btoc)	Water Elevation (ft amsl)(a)	Product Level (ft btoc)	Product Elevation (ft amsl)	Free Product
MW01	10/27/98	317.69	18-38.0	19.14	298.55	19.14	298.55	Sheen
	11/06/00			18.73	298.96 (298.97)	18.72	298.97	0.1
	01/11/01			17.60	300.09 (300.10)	17.59	300.10	0.1
	04/04/01			10.60	307.09	--	--	--
	07/16/01			11.17	306.52	--	--	--
	06/23/03			13.75	303.94	--	--	--
MW01A	10/27/98	317.52	5-15.0	7.22	310.30	--	--	--
	11/06/00			7.42	310.10	--	--	--
	01/11/01			2.26	315.26	--	--	--
	04/04/01			3.07	314.45	--	--	--
	07/16/01			5.06	312.46	--	--	--
	06/23/03			5.67	311.85	--	--	--
MW02	10/27/98	317.03	10-30.0	12.41	304.62	--	--	--
	11/06/00			15.96	301.07	15.96	301.07	Sheen
	01/11/01			16.07	300.96	16.07	300.96	Sheen
	04/04/01			8.04	308.99	--	--	--
	07/16/01			8.23	308.80	--	--	--
	06/23/03			9.85	307.18	--	--	--
MW03	10/27/98	318.28	10-30.0	14.04	304.24	--	--	--
	11/06/00			8.72	309.56	--	--	--
	01/11/01			8.28	310.00	--	--	--
	04/04/01			6.97	311.31	--	--	--
	07/16/01			5.37	312.91	--	--	--
	06/23/03			8.55	309.73	--	--	--
MW04	10/27/98	317.16	9-29.0	16.21	300.95	--	--	--
	11/06/00			21.76	295.40	--	--	--
	01/11/01			19.78	297.38	--	--	--
	04/04/01			10.78	306.38	--	--	--
	07/16/01			8.87	309.29	--	--	--
	06/23/03			17.48	299.68	--	--	--

TABLE 2-1
HISTORICAL GROUNDWATER AND
FREE PRODUCT LEVEL MEASUREMENTS, UST SITE 1441

Number Well	Date Measured	Top of Casing Elevation (ft amsl)	Screen Interval (ft btoc)	Water Level (ft btoc)	Water Elevation (ft amsl)(a)	Product Level (ft btoc)	Product Elevation (ft amsl)	Free Product
MW05	10/27/98	316.99	10-30.0	16.00	300.99	--	--	--
	11/06/00			20.26	296.73 (296.86)	20.11	296.88	0.15
	01/11/01			21.17	295.82 (296.81)	19.99	297.00	1.18
	04/04/01			7.85	309.135 (309.14)	7.85	309.14	Sheen
	07/16/01			11.54	305.45 (305.14)	11.515	305.475	0.025
	06/23/03			11.41	305.38	--	--	--

Notes:

- ^(a) Value in parentheses indicates groundwater elevation corrected for the presence of free product using a density factor for diesel fuel of 0.84 g/cm³.

Shading indicates water level was above the top of the screen.

amsl – above mean sea level

btoc – below top of casing

UST – Underground Storage Tank

TABLE 4-1
PROPOSED CLEANUP OBJECTIVES,
UST SITE 1441, MCB CAMP PENDLETON

Constituent	Groundwater	Soil
TPH-d	100 µg/L ^(a)	SPLP<Groundwater Objective
Benzene	1.0 µg/L ^(b)	SPLP<Groundwater Objective
Toluene	150 µg/L ^(b)	SPLP<Groundwater Objective
Ethylbenzene	680 µg/L ^(b)	SPLP<Groundwater Objective
Total Xylenes	1,750 µg/L ^(b)	SPLP<Groundwater Objective
Benzo[a]pyrene	0.2 µg/L ^(b)	SPLP<Groundwater Objective
Phenanthrene	1.0 µg/L ^(b)	SPLP<Groundwater Objective

Notes:

^(a) Secondary taste and odor threshold

^(b) Maximum Contaminant Level

µg/L – micrograms per liter

MCB – Marine Corps Base

SPLP – Synthetic Precipitation Leaching Procedure

TPH-d – total petroleum hydrocarbons quantified as diesel

UST – Underground Storage Tank

FIGURES

DRAWN BY: MD	CHECKED BY: MC	APPROVED BY: MC	DCN: SES-TECH-05-0040	DRAWING NO: 05004011.DWG
DATE: 07/29/05	REV: REVISION 0		CTO: #003	

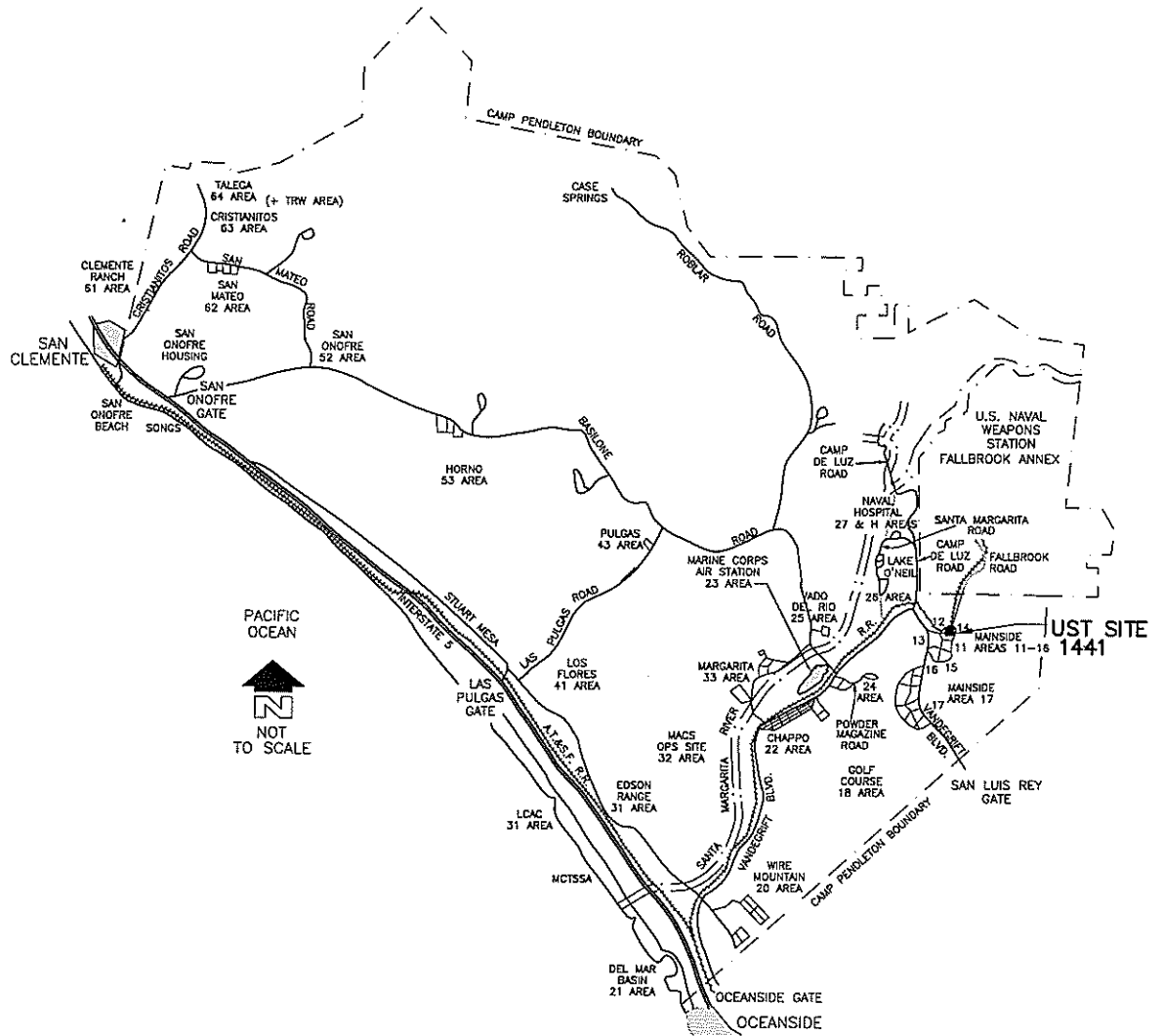


Figure 1-1
SITE VICINITY MAP

MCB CAMP PENDLETON

SES-TECH

DRAWN BY: MD	CHECKED BY: MC	APPROVED BY: MC	DCN: SES-TECH-05-0040	DRAWING NO:
DATE: 07/29/05	REV: REVISION 0		CTO: #003	05004021.DWG

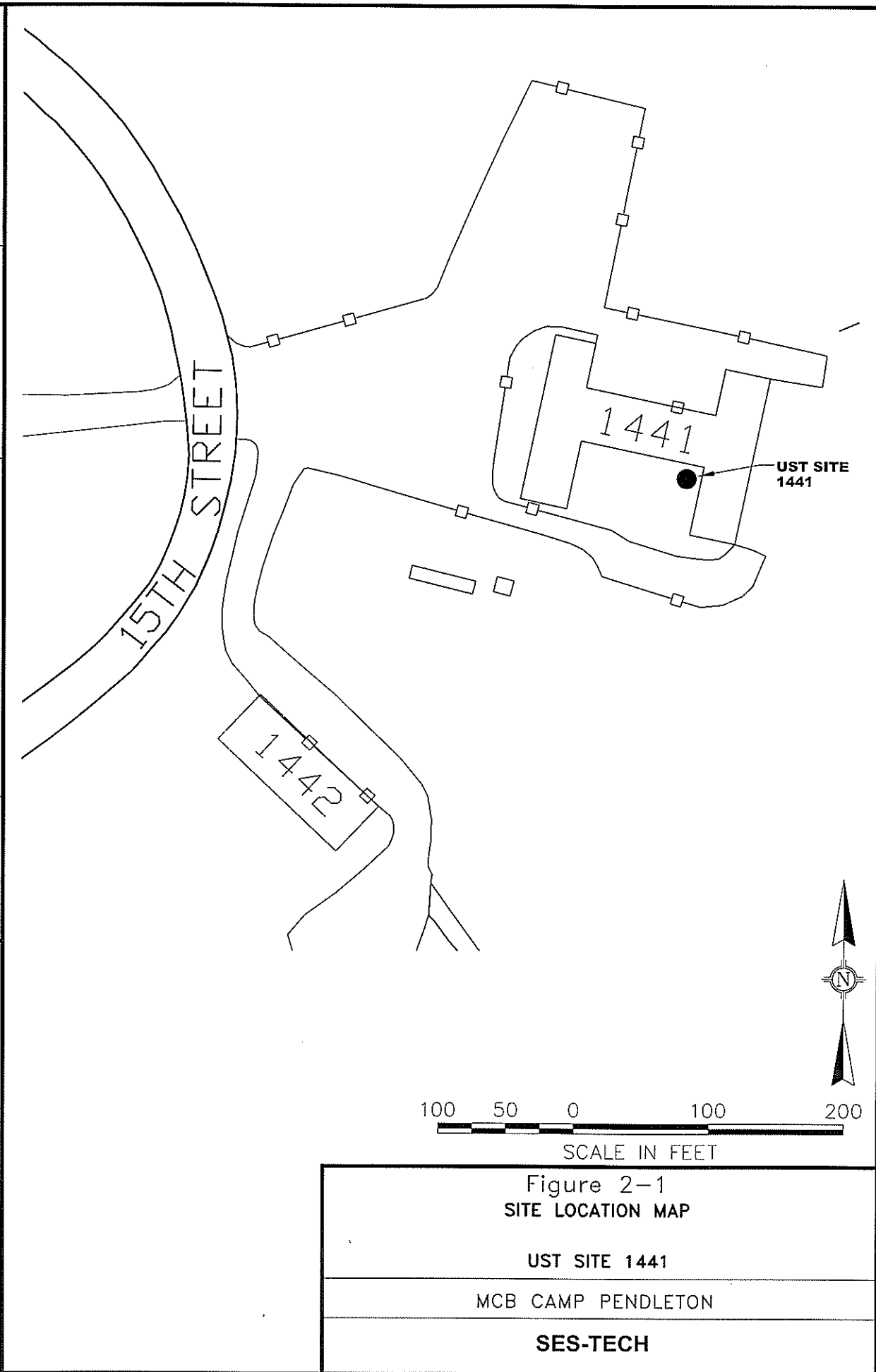
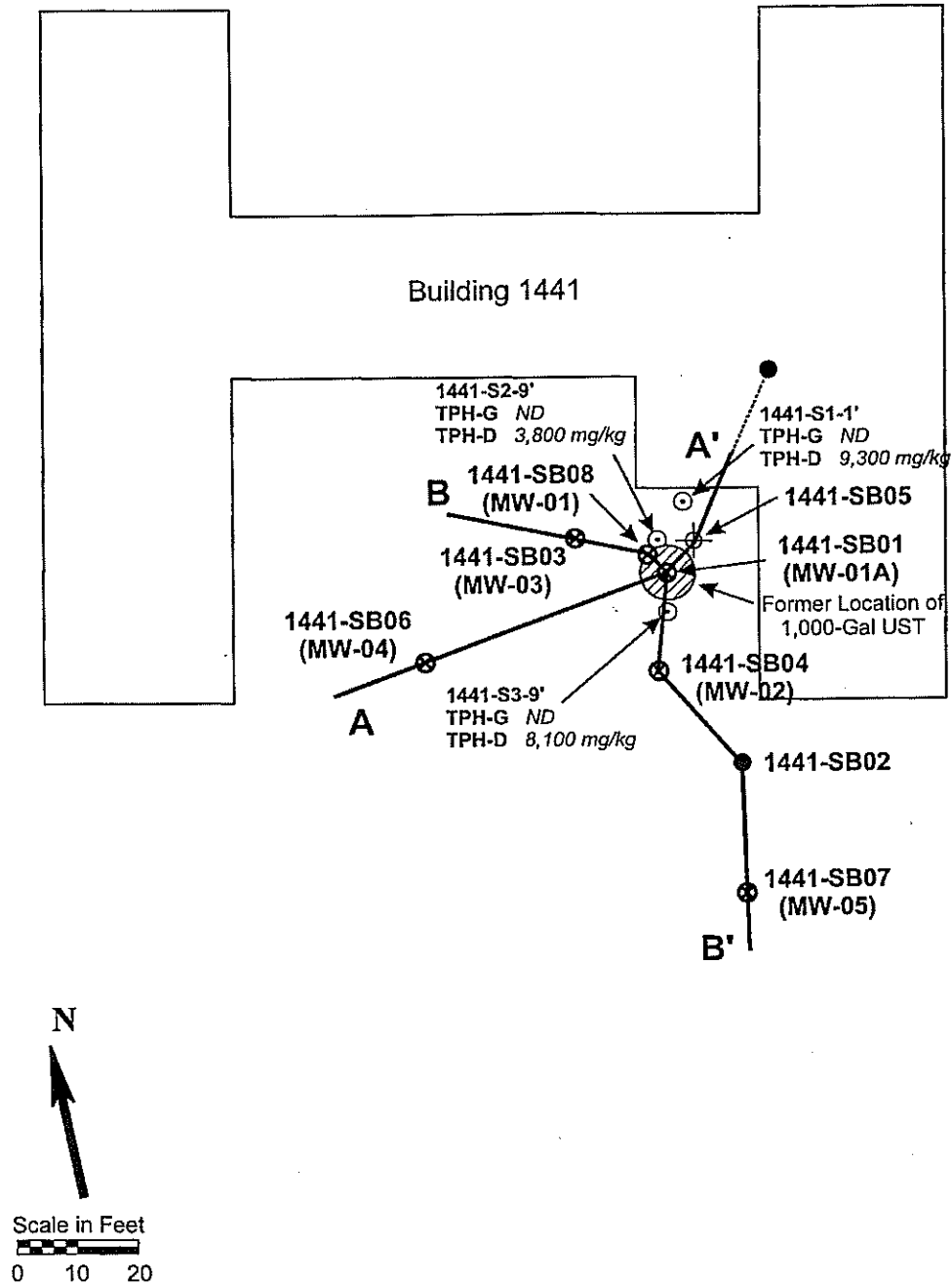


Figure 2-1 SITE LOCATION MAP
UST SITE 1441
MCB CAMP PENDLETON
SES-TECH

P:\2973-SESTECH\CTO-0003 PENDLETON\SITE 1441\05-0040 DRAFT WORK PLAN\DWG\05004021.DWG
PLOT/UPDATE: JUL 28 2005 09:21:13

DRAWING NO: 05004022.DWG	
DCN: SES-TECH-05-0040	CTO: #003
APPROVED BY: MC	REV: REVISION 0
CHECKED BY: MC	DATE: 07/29/05
DRAWN BY: MD	



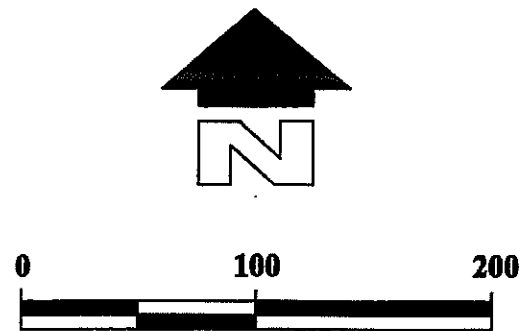
LEGEND:

- TANK REMOVAL SOIL SAMPLE LOCATION
- SITE ASSESMENT BORING LOCATION
- ⊗ SITE ASSESMENT MONITORING WELL LOCATION
- ⊕ ANGLE BORING LOCATION

Figure 2-2
LOCATION OF TANK REMOVAL SOIL SAMPLES AND
1999 SITE ASSESMENT BORINGS
UST SITE 1441

MCB CAMP PENDLETON

SES-TECH



SCALE IN FEET

LEGEND

- SOIL BORING LOCATION
- 1441 BUILDING NUMBER
- ROADWAY
- FORMER UST EXCAVATION/LOCATION

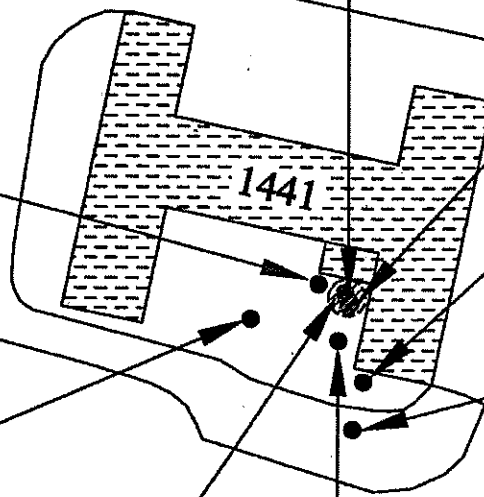
NOTES:

TPH-JF = TOTAL PETROLEUM HYDROCARBONS QUANTIFIED AS JET FUEL
TPH-D = TOTAL PETROLEUM HYDROCARBONS QUANTIFIED AS DIESEL
TPH-O = TOTAL PETROLEUM HYDROCARBONS QUANTIFIED AS OIL
VOCs = VOLATILE ORGANIC COMPOUNDS
PNAs = POLYNUCLEAR AROMATIC HYDROCARBONS
NA = NOT ANALYZED
ND = NOT DETECTED; REFER TO TABLE 2 FOR REPORTING LIMITS
* = SEE FIGURE 8 FOR VOC AND PNA DETECTIONS

Sample ID/Depth	TPH-JF (mg/kg)	TPH-D (mg/kg)	TPH-O (mg/kg)	VOCs (µg/kg)	PNAs (µg/kg)
1441-SB06-5'	<10	<10	<10	NA	NA
1441-SB06-10'	<10	1,000	<10	*	<330
1441-SB06-14'	<10	2,100	<10	*	*
1441-SB06-20'	<10	130	<10	NA	NA
1441-SB06-25'	<10	72	<10	NA	NA
1441-SB06-27'	<10	240	<10	*	<330
1441-SB06-30'	<10	440	<10	NA	<330
1441-SB06-32'	<10	19	<10	ND	<330
1441-SB06-35'	<10	350	<10	NA	<330
1441-SB06-40'	<10	45	<10	NA	NA
1441-SB06-45'	<10	29	<10	NA	NA
1441-SB06-50'	<10	33	<10	NA	NA

Sample ID/Depth	TPH-JF (mg/kg)	TPH-D (mg/kg)	TPH-O (mg/kg)	VOCs (µg/kg)	PNAs (µg/kg)
1441-SB03-5'	<10	<10	<10	NA	NA
1441-SB03-15'	<10	64	41	NA	NA
1441-SB03-22'	<10	120	29	NA	NA
1441-SB03-27'	<10	110	50	NA	NA
1441-SB03-30'	<10	2,400	160	*	*
1441-SB03-35'	<10	430	28	*	<330
1441-SB03-40'	<10	280	23	NA	NA
1441-SB03-44'	<10	380	25	NA	NA
1441-SB03-45'	<10	170	21	NA	NA
1441-SB03-50'	<10	98	85	ND	<330

Sample ID/Depth	TPH-JF (mg/kg)	TPH-D (mg/kg)	TPH-O (mg/kg)	VOCs (µg/kg)	PNAs (µg/kg)
1441-SB01-5'	<10	630	52	ND	<330
1441-SB01-GRAB8'	<10	2,300	320	NA	NA
1441-SB01-10'	<10	1,300	210	*	<330
1441-SB01-15'	<10	480	87	*	<330



Sample ID/Depth	TPH-JF (mg/kg)	TPH-D (mg/kg)	TPH-O (mg/kg)	VOCs (µg/kg)	PNAs (µg/kg)
1441-SB05-5'	<10	1,500	73	*	*
1441-SB05-10'	<10	1,000	59	*	*
1441-SB05-14'	<10	370	<10	NA	NA
1441-SB05-19'	<10	120	<10	NA	NA
1441-SB05-24'	<10	130	17	NA	NA
1441-SB05-26'	<10	51	16	ND	<330
1441-SB05-30'	<10	170	21	NA	<330
1441-SB05-35'	<10	82	12	NA	NA
1441-SB05-40'	<10	43	16	NA	NA
1441-SB05-45'	<10	22	19	NA	NA
1441-SB05-50'	<10	85	27	NA	NA
1441-SB05-55'	<10	100	32	NA	NA
1441-SB05-60'	<10	43	29	NA	<330

Sample ID/Depth	TPH-JF (mg/kg)	TPH-D (mg/kg)	TPH-O (mg/kg)	VOCs (µg/kg)	PNAs (µg/kg)
1441-SB02-5'	<10	<10	<10	NA	NA
1441-SB02-6.5'	<10	480	27	NA	NA

Sample ID/Depth	TPH-JF (mg/kg)	TPH-D (mg/kg)	TPH-O (mg/kg)	VOCs (µg/kg)	PNAs (µg/kg)
1441-SB07-5'	<10	<10	<10	NA	NA
1441-SB07-12'	<10	480	<10	NA	NA
1441-SB07-16'	<10	1,300	<10	NA	NA
1441-SB07-21'	<10	220	<10	NA	NA
1441-SB07-25'	<10	240	<10	NA	NA
1441-SB07-31'	<10	390	<10	NA	NA
1441-SB07-35'	<10	180	<10	NA	NA
1441-SB07-40'	<10	170	<10	NA	NA
1441-SB07-45'	<10	72	<10	NA	NA
1441-SB07-50'	<10	110	<10	NA	<330

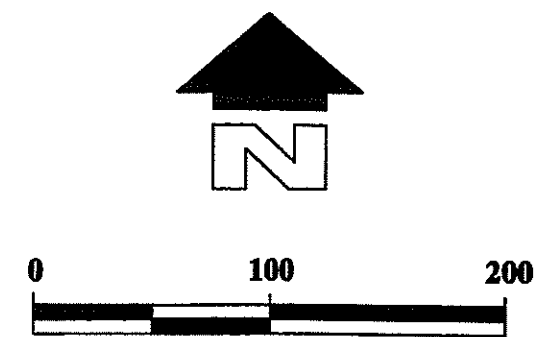
Sample ID/Depth	TPH-JF (mg/kg)	TPH-D (mg/kg)	TPH-O (mg/kg)	VOCs (µg/kg)	PNAs (µg/kg)
1441-SB04-5'	<10	940	71	*	<330
1441-SB04-10'	<10	280	14	*	<330
1441-SB04-15'	<10	55	24	NA	NA
1441-SB04-20'	<10	36	18	NA	NA
1441-SB04-25'	<10	77	21	NA	NA
1441-SB04-30'	<10	40	16	*	<330
1441-SB04-35'	<10	120	18	NA	NA
1441-SB04-40'	<10	100	15	NA	NA
1441-SB04-45'	<10	68	12	NA	NA
1441-SB04-47'	<10	13	<10	NA	NA
1441-SB04-52'	<10	27	18	ND	<330

Sample ID/Depth	TPH-JF (mg/kg)	TPH-D (mg/kg)	TPH-O (mg/kg)	VOCs (µg/kg)	PNAs (µg/kg)
1441-SB08-5'	<10	240	<10	NA	NA
1441-SB08-11'	<10	560	<10	NA	NA
1441-SB08-15'	<10	45	<10	NA	NA
1441-SB08-20'	<10	1,200	<10	NA	NA
1441-SB08-25'	<10	160	<10	NA	NA
1441-SB08-30'	<10	560	<10	NA	NA
1441-SB08-35'	<10	420	38	ND	<330
1441-SB08-40'	<10	330	44	NA	NA
1441-SB08-45'	<10	300	44	NA	NA
1441-SB08-50'	<10	78	<10	NA	NA
1441-SB08-55'	<10	57	11	ND	<330
1441-SB08-60'	<10	250	99	NA	NA

Figure 2-3
1999 SITE ASSESSMENT
SOIL SAMPLE RESULTS
UST SITE 1441

MCB CAMP PENDLETON

SES-TECH



SCALE IN FEET

LEGEND

- SOIL BORING LOCATION
- 1441 BUILDING NUMBER
- ROADWAY
- WATERWAY
- FORMER UST EXCAVATION/LOCATION

NOTES:
VOCs = VOLATILE ORGANIC COMPOUNDS
PNAs = POLYNUCLEAR AROMATIC HYDROCARBONS

ONLY THOSE COMPOUNDS DETECTED
ARE LISTED IN THIS FIGURE

Sample ID/Depth	VOCs (µg/kg)													PNAs (µg/kg)			
	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	4-Isopropylbenzene	Ethylbenzene	Isopropylbenzene	m,p-Xylene	o-Xylene	p-Xylene	sec-Butylbenzene	tert-Butylbenzene	Toluene	Acenaphthene	Fluorene	Naphthalene	Phenanthrene		
1441-SB 06-10'	<20	<20	46	<5.0	<20	<5.0	70	<20	76	<5.0	72	<20	<5.0	<330	<330	<330	<330
1441-SB 06-14'	<20	100	49	<5.0	27	<5.0	320	<20	250	<5.0	350	25	<5.0	420	530	<330	<330
1441-SB 06-27'	<20	<20	<20	<5.0	<20	<5.0	<20	<20	45	<5.0	<20	<20	<5.0	<330	<330	<330	<330

Sample ID/Depth	VOCs (µg/kg)													PNAs (µg/kg)			
	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	4-Isopropylbenzene	Ethylbenzene	Isopropylbenzene	m,p-Xylene	o-Xylene	p-Xylene	sec-Butylbenzene	tert-Butylbenzene	Toluene	Acenaphthene	Fluorene	Naphthalene	Phenanthrene		
1441-SB 01-10'	210	110	71	49	34	23	91	64	500	12	86	<20	<5.0	<330	<330	<330	<330
1441-SB 01-15'	31	22	<20	<5.0	<20	<5.0	<20	<20	120	<5.0	<20	<20	<5.0	<330	<330	<330	<330

Sample ID/Depth	VOCs (µg/kg)													PNAs (µg/kg)			
	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	4-Isopropylbenzene	Ethylbenzene	Isopropylbenzene	m,p-Xylene	o-Xylene	p-Xylene	sec-Butylbenzene	tert-Butylbenzene	Toluene	Acenaphthene	Fluorene	Naphthalene	Phenanthrene		
1441-SB 03-30'	2,600	780	580	48	290	290	530	470	1,300	110	750	<20	<5.0	1,100	1,400	2,300	3,100
1441-SB 03-35'	52	<20	<20	<5.0	<20	11	39	<20	66	<5.0	24	<20	6.1	<330	<330	<330	<330

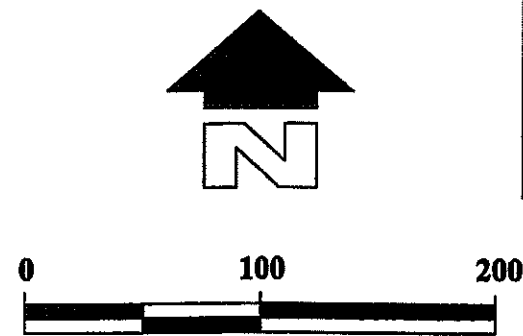
Sample ID/Depth	VOCs (µg/kg)													PNAs (µg/kg)			
	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	4-Isopropylbenzene	Ethylbenzene	Isopropylbenzene	m,p-Xylene	o-Xylene	p-Xylene	sec-Butylbenzene	tert-Butylbenzene	Toluene	Acenaphthene	Fluorene	Naphthalene	Phenanthrene		
1441-SB 05-5'	1,800	690	560	190	140	170	430	280	590	80	590	<20	<5.0	330	650	490	1,000
1441-SB 05-10'	340	230	220	65	32	34	130	65	320	17	170	<20	<5.0	<330	300	<330	740

Sample ID/Depth	VOCs (µg/kg)													PNAs (µg/kg)			
	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	4-Isopropylbenzene	Ethylbenzene	Isopropylbenzene	m,p-Xylene	o-Xylene	p-Xylene	sec-Butylbenzene	tert-Butylbenzene	Toluene	Acenaphthene	Fluorene	Naphthalene	Phenanthrene		
1441-SB 04-5'	<20	<20	47	<5.0	<20	<5.0	66	<20	<40	<5.0	63	<20	<5.0	<330	<330	<330	<330
1441-SB 04-10'	<20	<20	25	<5.0	<20	<5.0	43	<20	<40	<5.0	32	<20	<5.0	<330	<330	<330	<330
1441-SB 04-30'	<20	<20	<20	<5.0	<20	10	<20	<20	<40	<5.0	<20	<20	9.1	<330	<330	<330	<330

Figure 2-4
1999 SITE ASSESSMENT VOC AND PAH
SOIL SAMPLE RESULTS
UST SITE 1441

MCB CAMP PENDLETON

SES-TECH



SCALE IN FEET

LEGEND

- SOIL BORING LOCATION
- 1441 BUILDING NUMBER
- ROADWAY
- WATERWAY
- FORMER UST EXCAVATION/LOCATION

NOTES:
TPH = TOTAL PETROLEUM HYDROCARBONS
VOCs = VOLATILE ORGANIC COMPOUNDS
PNAs = POLYNUCLEAR AROMATIC HYDROCARBONS

ONLY THOSE COMPOUNDS DETECTED ARE LISTED IN THIS FIGURE

GROUNDWATER FLOW DIRECTION AND GRADIENT (OCTOBER 28, 1998)

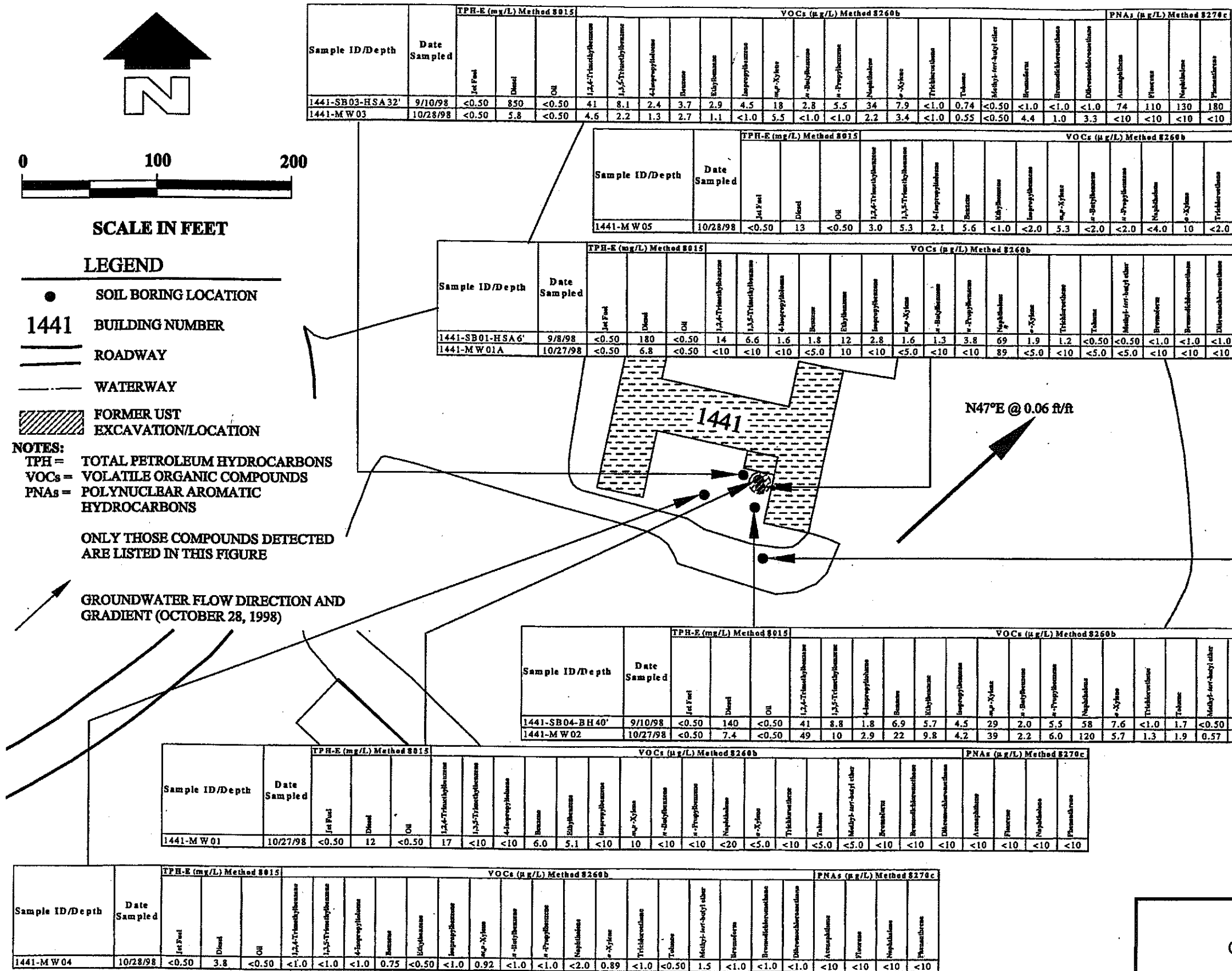


Figure 2-5
1999 SITE ASSESSMENT
GROUNDWATER SAMPLE RESULTS
UST SITE 1441

MCB CAMP PENDLETON

SES-TECH

DRAWN BY: MD	CHECKED BY: MC	APPROVED BY: MC	DCN: SES-TECH-05-0040	DRAWING NO:
DATE: 07/29/05	REV: REVISION 0	CTO: #003		05004026.DWG

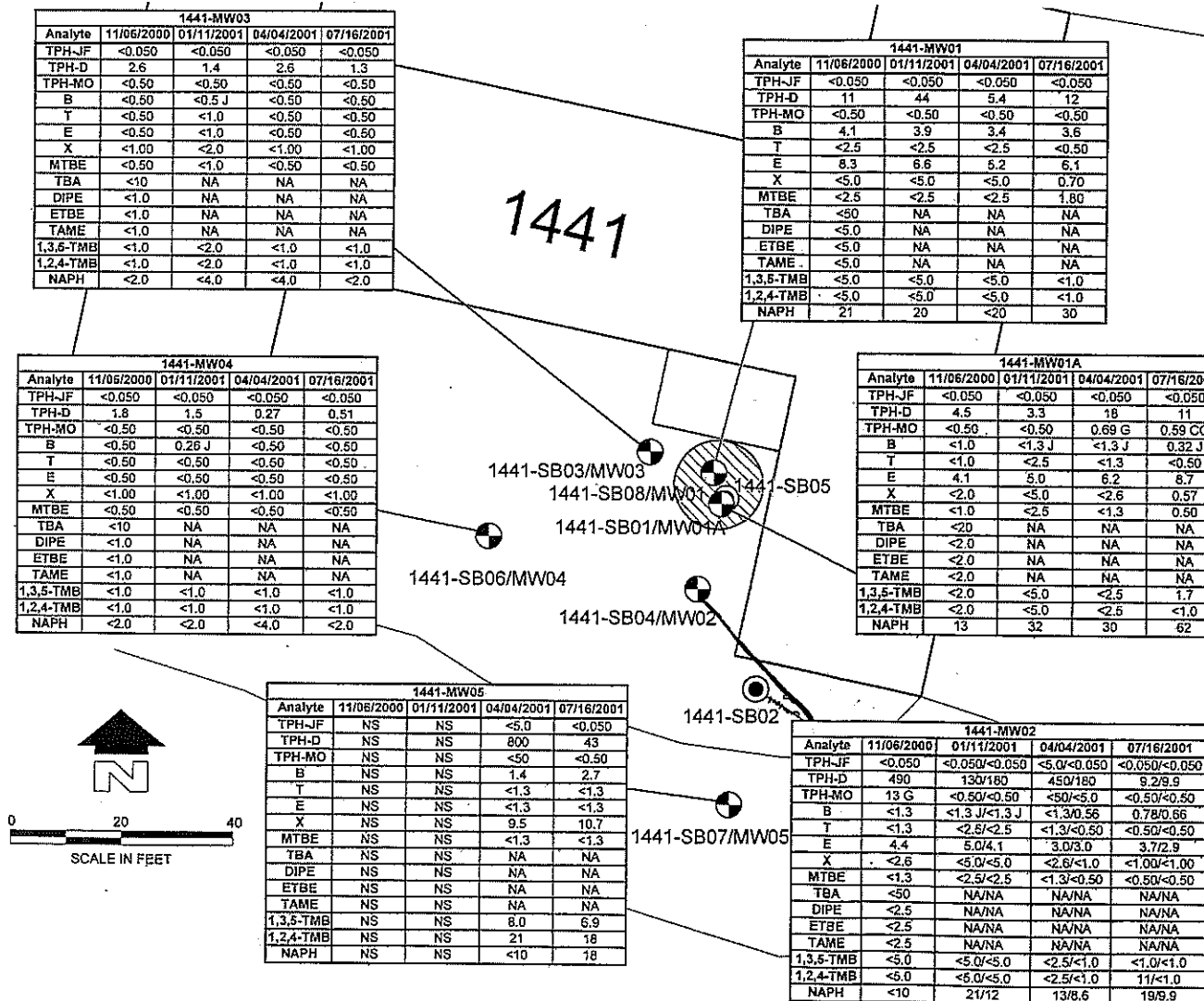
LEGEND

- MONITORING WELL (BATTELLE)
- ⊙ SOIL BORING LOCATION (BATTELLE)
- ▨ FORMER UST EXCAVATION LOCATION
- TPH-JF TOTAL PETROLEUM HYDROCARBONS EXTRACTABLE AS JET FUEL (mg/L)
- TPH-D TOTAL PETROLEUM HYDROCARBONS EXTRACTABLE AS DIESEL FUEL (mg/L)
- TPH-MO TOTAL PETROLEUM HYDROCARBONS EXTRACTABLE AS MOTOR OIL (mg/L)
- BTEX B= BENZENE, T= TOLUENE, E= ETHYLBENZENE, X= TOTAL XYLENES (μg/L)
- MTBE METHYL-TERT-BUTYL ETHER (μg/L)
- TMB TRIMETHYLBENZENE (μg/L)
- NAPH NAPHTHALENE (μg/L)
- TBA TERTIARY-BUTYL ALCOHOL (μg/L)
- DIPE DIISOPROPYL ETHER (μg/L)
- ETBE ETHYL-TERTIARY-BUTYL ETHER (μg/L)
- TAME TERTIARY-AMYL-METHYL ETHER (μg/L)
- C REPORTED CONCENTRATION INCLUDES ADDITIONAL COMPOUND UNCHARACTERISTIC OF COMMON FUELS AND LUBRICANTS
- G COMPOUNDS OUTSIDE THE RANGE OF DIESEL HAVE VARYING AMOUNTS OF RECOVERY
- NS NOT SAMPLED
- J ESTIMATED
- NA NOT ANALYZED

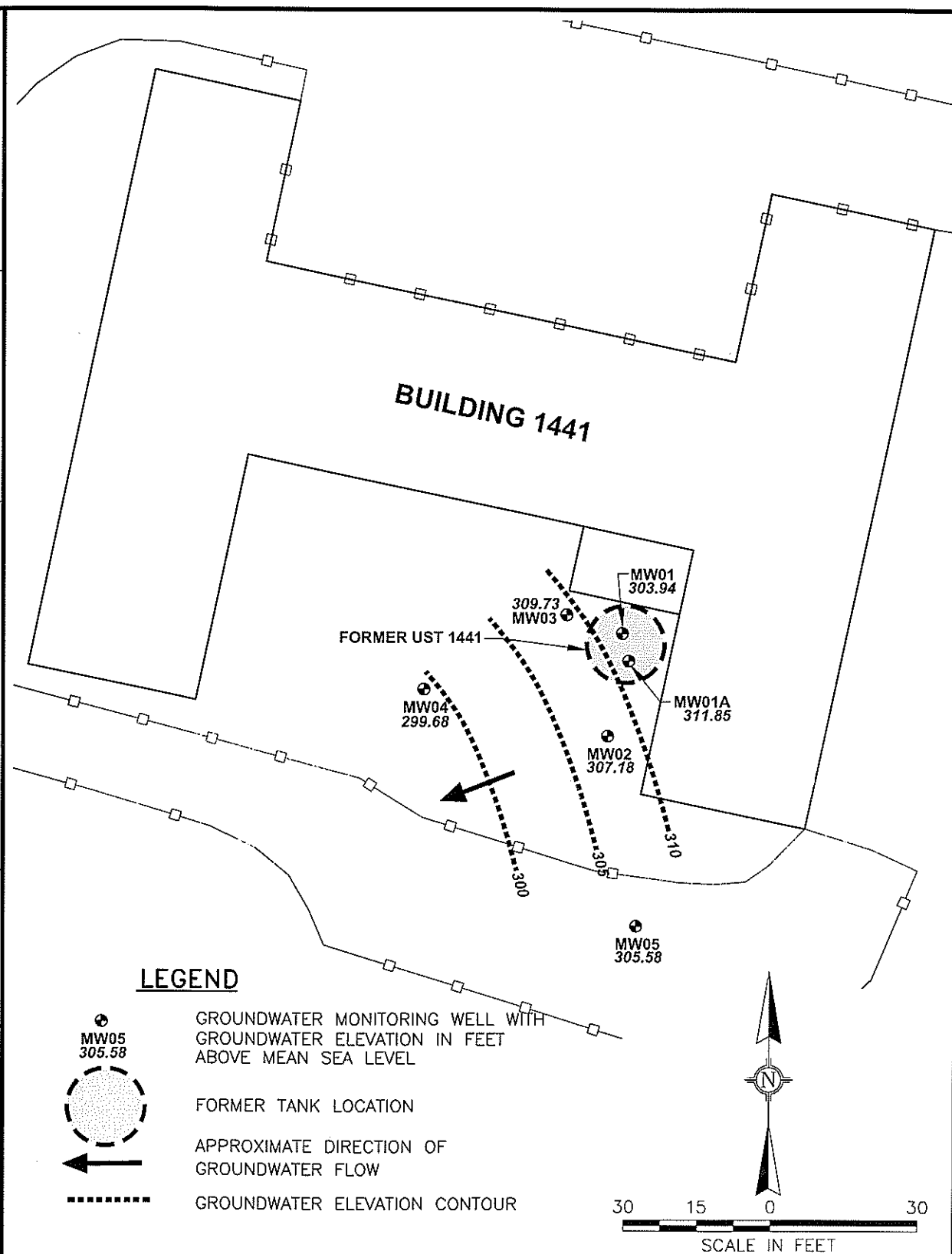
Figure 2-6
 2000 TO 2001 QUARTERLY
 GROUNDWATER SAMPLE RESULTS
 UST SITE 1441

MCB CAMP PENDLETON

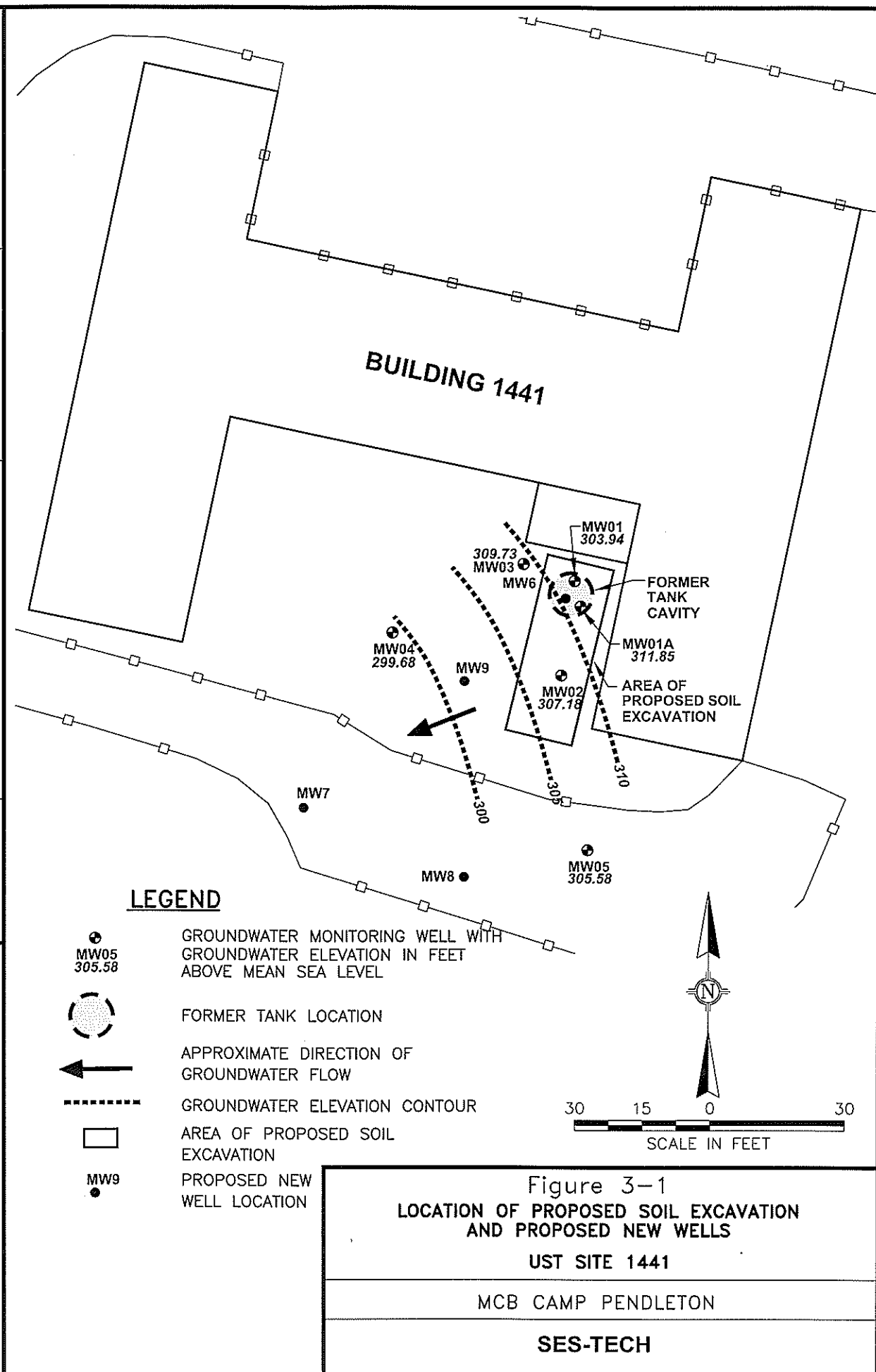
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DATE: 07/29/05	REV: REVISION 0		CTO: #003	



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DATE: 07/29/05	REV: REVISION 0		CTO: #003	



APPENDIX A

SAMPLING AND ANALYSIS PLAN

Naval Facilities Engineering Command, Southwest
Contracts Department
1220 Pacific Highway, Building 127, Room 112
San Diego, CA 92132-5190

CONTRACT NO. N68711-04-D-1104
CTO No. 0003

APPENDIX A

FINAL

SAMPLING AND ANALYSIS PLAN
UST SITE 1441, MCB CAMP PENDLETON
(Field Sampling Plan and Quality Assurance Project Plan)
Revision 1
September 6, 2005

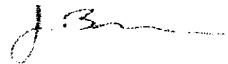
MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA

DCN: SES-TECH-05-0040

Prepared by:

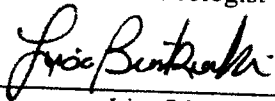
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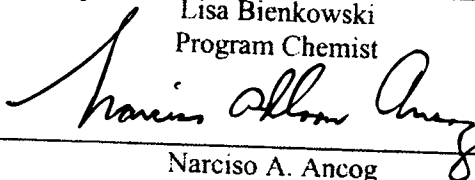
Jeff Brenner, P.G.
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Date

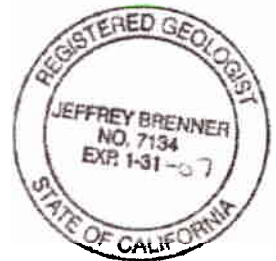


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Figure A.7-1	Project Organization Chart

ABBREVIATIONS AND ACRONYMS

%R	percent recovery
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CCV	continuing calibration verification
CDQMP	Chemical Data Quality Management Plan
CFR	Code of Federal Regulations
CTO	Contract Task Order
COC	chain-of-custody
DEH	Department of Environmental Health
DHS	California Department of Health Services
DIPE	di-isopropyl ether
DO	dissolved oxygen
DoD	Department of Defense
DON	Department of the Navy
DOT	Department of Transportation
DQO	data quality objective
DTSC	Department of Toxic Substances Control
EDCC	Electronic Data Consistency Checker
EDD	electronic data deliverable
EDF	electronic data format
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
ETBE	ethyl tert-butyl ether
EWI	Environmental Work Instruction
GC	gas chromatograph
GC/MS	gas chromatograph/mass spectrometer
ICAL	initial calibration
LCS	laboratory control sample
MCB	Marine Corps Base
MDL	method detection limit

ABBREVIATIONS AND ACRONYMS

(Continued)

mg/L	milligrams per liter
mg/kg	milligrams per kilogram
mL	milliliter
MS	matrix spike
MSA	Method of Standard Addition
MSD	matrix spike duplicate
MTBE	methyl tert-butyl ether
NaHSO ₄	sodium bisulfate
NAVFAC SW	Naval Facilities Engineering Command, Southwest
NCR	Nonconformance Report
NFEC SW	Southwest Division, Naval Facilities Engineering Command
NFESC	Naval Facilities Engineering Service Center
NIST	National Institute for Standards and Testing
ORP	oxidation/reduction potential
PAH	polynuclear aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, completeness, and comparability
PID	photoionization detector
PPE	personal protective equipment
QA	quality assurance
QAO	Quality Assurance Officer
QC	quality control
RL	reporting limit
ROICC	Naval Technical Representative/Resident Officer in Charge of Construction
RPD	relative percent difference
RWQCB	Regional Water Quality Control Board
SAM	Site Assessment and Mitigation
SAP	Sampling and Analysis Plan
SES-TECH	Sealaska Environmental Services LLC and Tetra Tech FW, Inc.
SIM	Selective Ion Monitoring

ABBREVIATIONS AND ACRONYMS

(Continued)

SOP	standard operating procedure
SPLP	Synthetic Precipitation Leaching Procedure
TAME	tert-amyl methyl ether
TBA	tert-butyl alcohol
TPH-d	total petroleum hydrocarbons quantified as diesel
UST	Underground Storage Tank
VOA	volatile organic analysis
VOC	volatile organic compound
WQO	Water Quality Objective

ELEMENTS OF EPA QA/R-5 IN RELATION TO THIS SAP

EPA QA/R-5 QAPP Element ^a	SES-TECH SAP
A1 Title and Approval Sheet	Title and Approval Sheet
A2 Table of Contents	Table of Contents
A3 Distribution List	Distribution List
A4 Project/Task Organization	7.0 Project Organization
A5 Problem Definition/Background	2.0 Background
A6 Project/Task Description	2.0 Background
A7 Quality Objectives and Criteria	8.0 Quality Assurance Objectives
A8 Special Training/Certification	8.2.1 Laboratory Qualifications
A9 Documents and Records	6.10 Field Documentation and Records
B1 Sample Process Design	6.0 Field Methods and Sampling Procedures
B2 Sampling Methods	6.0 Field Methods and Sampling Procedures
B3 Sample Handling and Custody	6.8 Sample Custody
B4 Analytical Methods	5.1 Analytical Methods
B5 Quality Control	5.3 Field Quality Control Samples 8.2 Analytical Data Quality Objectives
B.6 Instrument/Equipment Testing, Inspection, and Maintenance	6.2.4 Field Measurement Procedures 8.2.3 Laboratory Quality Control Procedures 8.2.4.10 Preventative Maintenance
B7 Instrument/Equipment Calibration and Frequency	6.2.4 Field Measurement Procedures 8.2.4.1 Calibration
B8 Inspection/Acceptance of Supplies and Consumables	9.2.1 Hard-copy Report
B9 Non-Direct Measurements	9.2.2 Electronic Data
B10 Data Management	9.0 Data Management
C1 Assessment and Response Actions	10.0 Quality Assurance Oversight
C2 Reports to Management	10.0 Quality Assurance Oversight
D1 Data Review, Verification, and Validation	9.1 Laboratory Data Review 9.4 Data Evaluation
D2 Verification and Validation Methods	9.3 Data Validation
D3 Reconciliation with User Requirements	8.1 Data Quality Objectives

Notes:

^a EPA. 2001. *EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, QAMS*. March.

EPA – U.S. Environmental Protection Agency

QA – quality assurance

QAPP – Quality Assurance Project Plan

SAP – Sampling and Analysis Plan

SES-TECH – Sealaska Environmental Services LLC and Tetra Tech FW, Inc.

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared for the Department of the Navy (DON) by SES-TECH, a joint venture between Sealaska Environmental Services LLC and Tetra Tech FW, Inc., under the Naval Facilities Engineering Command, Southwest (NAVFAC SW) Indefinite Delivery/Indefinite Quantity Environmental Remediation Contract No. N68711-04-D-1104. The purpose of this SAP is to provide guidance on sampling, analysis, and quality assurance (QA) for proposed soil excavation and groundwater sampling at Underground Storage Tank (UST) Site 1441 at the Marine Corps Base (MCB) Camp Pendleton, California.

This SAP will be used as a reference document by all field and laboratory personnel engaged in the sampling and analysis for this project. The SAP was prepared in accordance with the *Final Program Chemical Data Quality Management Plan* (CDQMP) (SES-TECH, 2005a). Included in this SAP are field sampling procedures, QA/quality control (QC) requirements, and data gathering methods that will be used during this project. Data quality objectives (DQOs) are also provided in this document. The QA elements of this SAP were prepared in accordance with the *EPA Requirements for Quality Assurance Project Plans*, *EPA QA/R-5*, *QAMS* [U.S. Environmental Protection Agency (EPA), 2001] to ensure that all data collected are precise, accurate, representative, complete, and comparable to meet their intended use.

1.1 OBJECTIVE

The objectives of this SAP are to: 1) provide guidance for the field sampling activities at the sites; 2) describe and establish consistent field sampling procedures; 3) establish data gathering, handling, and documentation methods; and 4) define QA/QC measures to ensure consistency and confidence in the data obtained.

The primary objective is to remediate petroleum hydrocarbon-impacted soil at the former UST Site 1441 at MCB Camp Pendleton. Other specific objectives will include the following:

- Excavating soil impacted with diesel fuel (up to approximately 225 cubic yards)
- Collecting and analyzing confirmation soil samples to ensure the effectiveness of the excavation process
- Collecting and analyzing groundwater samples during one year of quarterly monitoring from UST 1441 to evaluate groundwater quality
- Conducting waste characterization sampling of project-derived wastes generated during field activities for disposal purposes, as necessary

1.2 REGULATORY OVERSIGHT

The DON is the lead agency responsible for the project, and the California Regional Water Quality Control Board, San Diego Region (RWQCB) is the lead regulatory agency.

2.0 BACKGROUND

Site location and background, including a site description and previous site activities, are presented in Sections 1.0 and 2.0 of the Interim Work Plan. Information presented in the Interim Work Plan will not be duplicated here.

3.0 MAPS

The proposed excavation area, and groundwater sampling locations are depicted in the following figures:

Figure A.3-1 Location of Proposed Soil Excavation and Groundwater Monitoring
Well Locations

4.0 SAMPLING STRATEGY

This section describes the collection and analysis of soil and groundwater samples to meet the project objectives during field activities.

4.1 CONFIRMATION SOIL SAMPLING

Excavation of contaminated soils will be conducted during the project. An estimated 225 cubic yards of impacted soil will be excavated. The excavation will be approximately 15 feet by 40 feet laterally and extend vertically to approximately 10 feet below ground surface (bgs) or to the granodiorite bedrock. Box shoring will be used and will define the lateral extent of the excavation. Figure A.3-1 identifies the proposed area to be excavated. Excavation will proceed with an excavator. To evaluate the effectiveness of the excavation, a confirmatory soil sample will be collected from approximately each 20 linear feet of excavation sidewall and from the excavation bottom. Additional samples may be collected at the discretion of the field geologist based on visual observations or field instrument readings. It is anticipated that one confirmation soil sample will be collected from each sidewall and the bottom of the excavation.

Each sample will be collected and analyzed for total petroleum hydrocarbons quantified as diesel (TPH-d). The soil sample with the highest TPH-d concentration will be further analyzed for Synthetic Precipitation Leaching Procedure (SPLP)/TPH-d, SPLP/volatile organic compounds (VOCs) [including benzene, toluene, ethylbenzene, and total xylenes (BTEX), methyl tert-butyl ether (MTBE), tert-amyl methyl ether (TAME), tert-butyl alcohol (TBA), di-isopropyl ether (DIPE), ethyl tert-butyl ether (ETBE)] and SPLP/polynuclear aromatic hydrocarbons (PAHs). In the event that TPH-d is not detected in any of the soil samples, no further confirmation analyses will be required. Confirmatory soil samples will be collected in accordance with the procedures described in Section 6.1 of this SAP. If performed, SPLP results will be used to support site closure.

4.2 GROUNDWATER SAMPLING

Following soil excavation activities and installation of three new monitoring wells, groundwater samples will be collected from the site. Locations of the monitoring wells are depicted in Figure A.3-1. Groundwater samples will be analyzed for TPH-d; VOCs including BTEX, MTBE, TAME, TBA, DIPE, and ETBE; PAHs; and natural attenuation parameters (nitrate, sulfate, and ferrous iron).

Groundwater samples will be compared to the Water Quality Objectives (WQOs) listed in Table A.8-2. Groundwater samples will be collected in accordance with procedures in Section 6.2.

4.3 WASTE CHARACTERIZATION SAMPLING

Waste generated during site activities will consist of purge water and decontamination water, which will be stored on site in 55-gallon drums and excavated soils which will be stockpiled onsite. Drums will be labeled and placed in a secure area. Analytical results from this and previous site assessment activities will be used for profiling of the waste. Additional analyses will not be performed on the drums for characterization, unless required by the disposal facility. If required, additional analyses will include: TPH-d, VOCs, and PAHs. Stockpile samples will be collected to characterize the excavated soils by analyzing for TPH-d, VOCs, and PAHs as necessary. Sampling procedures are described in Section 6.3.

Personal protective equipment (PPE) will not be sampled for waste characterization, but will be characterized based on knowledge of the process generating the waste. The results of the groundwater sampling will be used to classify the PPE.

4.4 BACKFILL MATERIAL SAMPLING

The excavation will be backfilled using imported fill material obtained from a sand and gravel quarry or from one of the Base's borrow pits. Samples will be collected from each imported material source prior to use as described in Section 6.4. The California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) *Information Advisory for Clean Imported Fill Material* (DTSC, 2001) will be used as a guidance document to determine the sampling frequency and analysis. All backfill material samples, at a minimum, will be analyzed for Title 22 metals and pH, and results will be compared against the *Preliminary Remediation Goals (PRGs) for Industrial Soil* (EPA, Region 9, 2004) except for arsenic, which is based on *Remedial Investigation/Feasibility Study Background Study for the MCB, Camp Pendleton, California* (SWDIV, 1997). If the Base's borrow pit is used, samples will also be analyzed for TPH-d. In addition to these analyses, a current certificate should be obtained from the quarry providing material to ensure that the material does not contain asbestos. If the facility cannot provide a certificate, then asbestos analysis will be required, unless this same material has been sampled by SES-TECH within the last year and is below the required limit for asbestos.

5.0 REQUEST FOR ANALYSIS

This section describes the analytical methods, sample containers, and preservative requirements. Additionally, field QC samples to be collected for this project will be discussed in this section.

5.1 ANALYTICAL METHODS

The following EPA analytical methods [*Test Methods for Evaluating Solid Waste, Physical Chemical Methods, SW-846*, Third Edition and final updates (EPA, 1986)] will be used to analyze soil and water samples during this project.

Soil Samples:

- TPH-d by EPA Method 3550B/8015B for confirmation and stockpile soil samples
- VOCs by EPA Method 5035/8260B for stockpile soil samples
- PAHs by EPA Method 3550B/8270C Selective Ion Monitoring (SIM) for stockpile soil samples [EPA Method 3550B/8310 will be used if EPA 3550B/8270C SIM reporting limits (RLs) cannot support action levels as listed in Table A.8-2]
- SPLP/TPH-d by EPA Method 1312/8015B for confirmation soil samples
- SPLP/VOCs (including BTEX, MTBE, TAME, TBA, DIPE, and ETBE) by EPA Method 1312/8260B for confirmation soil samples
- SPLP/PAHs by EPA Method 1312/8270C SIM for confirmation soil samples (EPA Method 1312/8310 will be used if EPA 1312/8270C SIM RLs cannot support action levels as listed in Table A.8-2)
- Title 22 metals by EPA Methods 3050B/6010B/7471A for backfill soil samples
- pH by EPA Method 9045C for backfill soil samples

Water Samples:

- TPH-d by EPA Method 3520C/8015B for groundwater, decontamination water samples, and equipment rinsates
- VOCs by EPA Method 5030B/8260B for groundwater, decontamination water samples, and equipment rinsates
- PAHs by EPA Method 3520C/8270C Selective Ion Monitoring (SIM) for groundwater, decontamination water samples, and equipment rinsates (EPA Method 3520C/8310 will be used if EPA 3520C/8270C SIM RLs cannot support action levels as listed in Table A.8-2)
- Nitrate and Sulfate by EPA Method 300.0 for groundwater samples

Detailed information on methods, calibration criteria, project-required RLs, and QC acceptance criteria are presented in Section 8.0.

5.2 SAMPLE CONTAINERS, PRESERVATIVES, AND HOLDING TIMES

Sample containers, preservatives, and holding time requirements will be in accordance with the EPA requirements presented in Table A.5-1. The subcontractor laboratory will provide sample containers that are certified pre-cleaned according to EPA protocols. The laboratory will guarantee the purity of preservation chemicals.

5.3 FIELD QUALITY CONTROL SAMPLES

Field QC samples will be collected and analyzed during the project to assess the consistency and performance of the sampling program. Field QC samples are necessary for establishing data comparability, determining the total measurement error (the overall precision of the measurement system from sample collection to analysis) and for QA during sample handling and shipment. Field QC samples may include field duplicates, equipment rinsates, source blanks, trip blanks, and temperature blanks. QA samples, which are the splits of the primary samples, may be also collected if justified by the project DQOs. Field QC samples will not be applicable to the collection of waste characterization samples.

5.3.1 Field Duplicates

Field duplicates consist of two distinct samples (an original and a duplicate) of the same matrix collected at the same time and location to the extent possible and using the same sampling techniques. The purpose of field duplicates is to measure the consistency of field sampling. Field duplicates will be collected at a frequency of one for every ten samples per matrix and will be analyzed for the same analytes as the original sample. Field duplicates are uniquely identified so that the identity of the field duplicates is “blind” to the analytical laboratory. Exact locations of field duplicate samples and their identifications will be recorded in the field logbook.

5.3.2 Equipment Rinsate Samples

Equipment rinsate is a sample of analyte-free water collected from a final rinse of sampling equipment after the decontamination procedure has been performed. Rinsate samples will be collected directly from the sampling equipment, placed in appropriate pre-cleaned containers supplied by the analytical laboratory, and analyzed for the same analytes as the field samples under the same analytical conditions. Equipment rinsate samples, collected at a frequency of one per each day of sampling, will help determine the effectiveness of the decontamination procedure and potential for cross-contamination during sampling events.

5.3.3 Source Blank Samples

A source blank consists of analyte-free, reagent-grade water provided by the laboratory to be used for the collection of equipment rinsate samples as described in Section 5.3.2. In order to assure that the source blank is free of contamination, one of two courses of action will be followed before the source blank water is used. First, the laboratory will be asked to provide a

certificate of analysis that the water provided for the equipment rinsate samples does not contain analytes above the project RLs. If the laboratory cannot provide a certificate of analysis, then a sample of the laboratory water will be collected at the beginning of the project and analyzed for the same parameters as the equipment rinsate samples to verify that the results are not above the project RLs. Source blank samples will only be collected if equipment rinsate samples are to be collected for the project.

5.3.4 Trip Blanks

Trip blanks are hydrochloric acid-preserved, analyte-free, deionized water prepared by the laboratory in 40-milliliter (mL) volatile organic analysis (VOA) vials that will be carried to the field, stored with the samples, and returned to the laboratory for volatile organic compound (VOC) analysis. Trip blanks will be used to determine if samples have been cross-contaminated with VOCs during sample transportation to the laboratory. One trip blank will be provided in each cooler, which contains water samples for VOC analysis.

5.3.5 Temperature Blanks

Temperature blanks are containers of tap water that will be shipped in each cooler containing field samples and ice. Laboratory personnel will use temperature blanks to measure the temperature of the cooler upon arrival at the laboratory.

6.0 FIELD METHODS AND SAMPLING PROCEDURES

The following sections provide the sampling procedures and sample handling procedures to be used for this project.

6.1 CONFIRMATION SOIL SAMPLING PROCEDURES

The following steps summarize the confirmation soil sampling procedures to be performed.

1. Sampling personnel will don a new pair of disposable nitrile gloves immediately before collecting soil samples at each location.
2. An excavator will be used to obtain soil samples from the sidewalls and the bottom of the excavation. One sample will be collected from approximately each 20 linear feet of excavation sidewall and from the excavation bottom.
3. Immediately upon reaching the surface, grab samples will be collected from the excavator bucket from material not in direct contact with the excavator bucket.
4. Samples will be placed into appropriate containers listed in Table A.5-1 using a new, individually packaged, disposable plastic scoop. Sample transfer into the jars will be accomplished so as to minimize soil disturbance. Jars will be filled completely to minimize headspace. En Core samples for VOCs will only be collected for waste/soil samples as described in Section 6.3.3. Confirmation soil samples for SPLP/VOCs analysis will be analyzed by EPA Method 1312/8260B.
5. Samples will be immediately labeled and custody-sealed, placed in resealable bags, and stored on ice as described in Sections 6.7 and 6.9.
6. The sample number, date, time, and description of the sample will be recorded on the chain-of-custody (COC) record and in the field logbook. All entries will be written in indelible black or blue ink.
7. All non-disposable sampling equipment will be decontaminated prior to each use as described in Section 6.5.

6.2 GROUNDWATER SAMPLING PROCEDURES

Groundwater sampling will be performed as described in the following sections.

6.2.1 Water Level Measurement Procedure

Water level measurements will be recorded from the wells before sampling. The following procedure will be used to obtain water level measurements:

1. Sampling personnel will don a new pair of disposable nitrile gloves immediately before collecting water level measurements at each well.

2. The water level probe will be decontaminated as described in Section 6.5.
3. The probe will be lowered slowly until the instrument alarm indicates that the water surface has been encountered. The measurement will be taken from the surveyed point mark on the top of the well casing.
4. The measurement will be checked by slowly raising and lowering the tape and watching the instrument response. The final measurement will be recorded in the field logbook.
5. After recording the water level measurement, the probe will be lowered to the bottom of the well to determine the total well depth. The measurement will be taken from the surveyed point mark on the top of the well casing. The final well depth measurement will be recorded in the field logbook.
6. After withdrawing the probe from the well, the decontamination procedure described in Section 6.5 will be followed to prevent cross-contamination.
7. This procedure will be modified to meet the operational requirements of an oil/water interface probe in wells where two phases are present or expected.

6.2.2 Well Purging Procedure

Wells will be purged in accordance with procedures outlined in the Site Assessment and Mitigation (SAM) Manual [Department of Environmental Health (DEH), 2005]. For all wells, the low-flow purging and sampling method will be implemented as described in Section 6.2.3. Discharge water, generated during purging and sampling, will be contained in 55-gallon drums, or temporarily contained in a plastic tank of approximately 300-gallon capacity, then transferred to a mobile tank prior to transport to the disposal facility.

6.2.3 Low-flow Purging and Sampling Method

The following procedures will be used to purge and sample wells:

1. Sampling personnel will don a new pair of disposable nitrile gloves immediately before purging each well.
2. The decontaminated pump (bladder or submersible) attached to new or decontaminated Teflon[®] tubing will be lowered and set in the middle of the well screen. To minimize disturbance of the groundwater flow conditions, the pump must be placed carefully into the well and lowered into the screen zone as slowly as possible.
3. The decontaminated water level probe will be lowered into the well to monitor water level drawdown during purging.
4. Once the pump and the probe have been lowered into place, then purging will begin. The flow rate must not exceed 1 liter per minute (or 0.26 gallons per minute), with an overall goal of less than 0.1 meter (0.33 feet) of drawdown and a stabilization of the water level in the well. The flow rate will be measured using a graduated cylinder or equivalent.

5. During purging, pH, temperature, conductivity, and turbidity will be measured using flow through a cell and a calibrated water quality meter, and recorded on the Low-flow Purging and Sampling Data Sheet a minimum of three times. The parameters will be measured and recorded every 3 to 5 minutes until parameters have stabilized.
6. Continuous monitoring of water quality indicator parameters is used to determine when purging is completed and sampling should begin. Sampling will commence when water quality indicators are stabilized during three consecutive readings every 3 to 5 minutes. See Section 6.2.4 below for stability criteria for each water quality parameter.
7. After the groundwater parameters have stabilized, groundwater samples will be collected from the pump discharge. If necessary, the flow rate will be decreased to minimize spilling and minimize turbulent flow during sample collection. At no time shall the sampling flow rate exceed the purging flow rate.
8. Groundwater samples will be collected in the following order: volatile analyses and semivolatile analyses. Sample container and preservation requirements specified in the SAP must be followed. Every attempt must be made to collect VOC samples at the lowest rate feasible.
9. Once established, the flow rate should be reproduced with each subsequent sampling event. If a significant change in initial water level occurs between events, it may be necessary to re-establish the optimum flow rate at each sampling event.
10. Sampling personnel will don a new pair of disposable nitrile gloves prior to sampling.
11. Samples will be transferred from the discharge hose of the pump to sample containers. If a sampling pump is used (such as, Grundfos or Redi-flo2[®]), the flow rate will be reduced for VOC sampling. Care will be taken to avoid agitating the sample to minimize loss of VOCs. VOA containers will be filled first as described in Section 6.2.3.1.
12. Samples will be collected in pre-preserved, pre-cleaned sample containers. Sample containers will be labeled and custody-sealed, placed in resealable bags, and stored on ice as described in Sections 6.7 and 6.9.
13. The sample number, date, time, and description of the sample will be recorded on the COC record and in the field logbook. All entries will be written in indelible black or blue ink.
14. The equipment is then removed from the well. All non-disposable sampling equipment will be decontaminated prior to sampling at the next well according to the procedure described in Section 6.5.
15. **Note:** When using this procedure, it is crucial to collect the groundwater samples using the same pump or device used for low-flow purging without moving it or causing disturbance to the well.

6.2.3.1 Volatile Organic Analysis Sampling

VOA samples require a special collection technique. Field sampling will be planned ahead and conducted in consideration of the following conditions:

- Field sampling must be performed in a manner that aeration or mixing of the sample material is avoided.
- Handling and storage of samples must ensure that exposure of the sample to elevated temperatures at any point during the sample collection is avoided.
- Exposure of the collected sample to air must be minimized.

Steps for the water sample collection for VOCs will be as follows:

1. The water samples will be collected into three 40-milliliter (mL) VOA vials carefully to minimize aeration.
2. The vial will be filled up to the lid until a positive meniscus is formed.
3. The vial will be capped immediately, but slowly.
4. The sample will be checked for the presence of air bubbles.
5. If an air bubble is present, the collected sample will be discarded and resampled using a new vial.
6. The previous steps will be repeated until an air-bubble-free sample is collected.

6.2.4 Field Measurement Procedures

Field water quality measurements will be made on groundwater samples during purging using a Horiba® U-22 water quality meter or equivalent instrumentation. During the low-flow purging and sampling method, the water quality meter will be equipped with a flow-through cell. The meter will be used to measure pH, temperature, conductivity, and turbidity of purge water. Instrument calibration and analysis procedures will follow the instrument manufacturer's instruction manual. Sample measurement will be done after the instrument has been successfully calibrated. A minimum of three readings will be collected during the purging of the well. Stabilization criteria used in the low-flow purging and sampling method are included below.

Groundwater samples may also be monitored for oxidation/reduction potential (ORP) and dissolved oxygen (DO) using field instruments.

6.2.4.1 pH

The pH will be measured using the water quality meter. The meter will be calibrated daily before use according to the instrument manufacturer's instruction manual. Results will be recorded within 0.1 pH unit precision. The pH will be considered stabilized during low-flow purging when readings are measured within ± 0.2 units.

6.2.4.2 Temperature

Temperature of groundwater will be measured using the water quality meter. The instrument manufacturer's instruction manual will be followed for meter calibration. Measurement of the field samples will proceed after calibration is finished. Results will be recorded to the nearest

0.1 degree Celsius (°C). The temperature will be considered stabilized during low-flow purging when readings are measured within ± 3 percent of previous reading.

6.2.4.3 Conductivity

The water quality meter will be calibrated for conductivity daily before use according to the instrument manufacturer's instruction manual. Results will be recorded to the nearest 0.1 micromhos per centimeter or microsiemens per centimeter. The conductivity will be considered stabilized during low-flow purging when readings are measured within ± 5 percent of previous reading.

6.2.4.4 Turbidity

Turbidity will be measured using the water quality meter. Instrument calibration and sample measurement procedures will follow the manufacturer's instruction manual. Results will be recorded in nephelometric turbidity units. The turbidity will be considered stabilized during low-flow purging when readings are measured within ± 10 percent of the previous reading.

6.2.4.5 Oxidation/Reduction Potential

Prior to the day's sampling, the performance of the probe will be verified in accordance with the procedures outlined by the manufacturer. There is no calibration procedure for an ORP probe. The verification procedure involves immersing the probe in a standard solution to obtain a reference (E_{ref}) reading (in millivolts) that confirms that the probe is functioning properly. The field measurements (E_{meas}) taken with the ORP probe are added to the reference value. The ORP, or " E_h " value, is calculated by the following formula:

$$E_h = E_{meas} + E_{ref}$$

At the end of the day, the ORP probe verification procedure will be repeated to ensure proper functioning of the instrument during sampling. The ORP will be considered stabilized during low-flow purging when readings are measured within ± 20 millivolts.

6.2.4.6 Dissolved Oxygen

The DO instrument will be calibrated each day, using a two-point calibration, in accordance with the procedures provided by the manufacturer. An oxygen-saturated solution will be generated by introducing air into deionized water in a container by bubbling with a small air pump or by agitating vigorously for 2 to 4 minutes. This will yield an oxygen concentration up to approximately 8 milligrams per liter (mg/L) and will serve as a temperature-corrected high-DO verification standard. A table of oxygen-saturation values in water at various temperatures is included in the instrument manual and will be used to define the temperature-corrected DO-saturation value for the calibration. A low verification standard will consist of approximately 300 mL of deionized water into which an excess of sodium bi-sulfate (NaHSO_4) has been added.

NaHSO₄ will remove virtually all of the oxygen present in the water, yielding an effective concentration of zero mg/L for the zero-point calibration. To account for uncertainties and variables in DO data collection, all results will be reported with a \pm factor of up to 15 percent, as a guideline for data interpretation. At the end of the day, the calibration verification procedure will be repeated to ensure proper functioning of the instrument during sampling. The DO will be considered stabilized during low-flow purging when readings are measured within ± 0.2 mg/L.

DO readings will be carried out either *in situ* by immersing the probe into the well, or *ex situ* by immersing the probe into samples immediately upon collection. If the *ex situ* method is used, care will be taken to minimize sample agitation during collection.

6.2.5 Instrument Corrective Action Procedure

Appropriate corrective actions must be taken when the calibration of a field instrument fails the instrument-specific calibration QC criteria. The following steps will be followed:

1. Check the instrument.
2. Investigate the cause of failure.
3. Recalibrate the instrument.
4. If the instrument recalibration fails, call the instrument manufacturer for assistance.
5. If the problem persists, send the instrument for service.
6. If a rental instrument is used, contact the rental office for immediate replacement of the instrument.
7. If possible, keep a backup instrument on site.

6.3 WASTE CHARACTERIZATION SAMPLING PROCEDURES

Drums of purge water and decontamination water and excavated soil will be generated during field activities. The analytical results from this and previous site assessment activities will be used to characterize the water. Additional samples will not be collected, unless required by the disposal facility. Stockpile samples will be collected for waste characterization of the excavated soil as necessary. Waste characterization sampling procedures are discussed in the following subsections.

6.3.1 Wastewater Sampling Procedures

Waste contained in drums will be sampled for characterization as follows:

1. Sampling personnel will put on a new pair of disposable nitrile gloves immediately before collecting samples at each drum.
2. One liquid sample per every drum will be collected. If the waste is stored in a tank, one sample will be collected from the tank.

3. The bung top of the drum or other approved container will be carefully opened and a measurement of the atmosphere inside will be taken using a photoionization detector (PID).
4. If the PID reads zero, proceed with completely opening the drum or container. If there are indications that VOCs exist inside, the project health and safety person should be contacted for directions.
5. Liquid samples will be collected using disposable Teflon bailers. Samples will be transferred from the bailers to pre-preserved, pre-cleaned sample containers using a bottom-emptying device. Vials for VOC analysis will be filled according to Section 6.2.3.1.
6. Sample containers will be labeled and custody-sealed, placed in resealable bags, and stored on ice as described in Sections 6.7 and 6.9.
7. The sample number, date, time, and description of the sample will be recorded on the COC record and in the field logbook. All entries will be written in indelible black or blue ink.
8. All non-disposable sampling equipment will be decontaminated prior to each use as described in Section 6.5.

6.3.2 Soil Stockpile Sampling Procedures

Soil stockpile samples will be collected as follows:

1. The volume (in cubic yards) of the stockpiles will be calculated using the following formulas:

$$V = A * H / 27$$

Where: V = volume in cubic yards

A = Area of the base of the stockpile in square feet calculated using one of the following formulas:

Rectangular = length * width

Square = length * width

Triangular = ½ base * height

Circular = 3.14 * radius * radius

Oval = 3.14 * long radius * short radius

H = average height of the stockpile in feet

27 = conversion factor for cubic feet to cubic yards

2. The number of samples required will be based on guidelines in accordance with the SAM Manual (DEH, 2005) or as required by the disposal facility.
3. The sample locations will be determined by using random number generation.

4. A backhoe or excavator bucket may be used to access the random sample point.
5. If soil samples are being collected for VOC analysis (and not SPLP/VOC analysis) En Core[™] samplers and EPA Method 5035 will be used for the collection and preparation of volatile soil samples as described in Section 6.3.3 below.
6. Sample containers will be labeled and custody-sealed, placed in resealable bags, and stored on ice as described in Sections 6.7 and 6.9.
7. The sample number, date, time, and description of the sample will be recorded on the COC record and in the field logbook. All entries will be written in indelible black or blue ink.
8. All nondisposable sampling equipment will be decontaminated prior to each use as described in Section 6.5.

6.3.3 En Core Sampling Procedures

En Core samplers and EPA Method 5035 will be used for the collection and preparation of soil/waste samples for volatile analysis.

1. Three En Core samples will be collected for VOC analysis.
2. Holding the coring body, the plunger rod will be pushed down until the small o-ring rests against the tabs. This will ensure that the plunger will move easily.
3. The locking lever on the En Core T-handle will be depressed. The coring body, with the plunger end first, will be placed into the open end of the T-handle, aligning the slots of the coring body with the locking pins in the T-handle. The coring body will be twisted clockwise to lock the pins in the slots. The sampler will be checked to ensure that it is locked in place. The sampler will now be ready for use.
4. By holding the T-handle, the coring body will be pushed into the soil until the coring body is full. When full, the small o-ring will be centered in the T-handle viewing hole. The sampler will then be removed from the soil and any excess soil will be wiped from the coring body exterior.
5. The coring body will be capped while it is still on the T-handle. The cap should be pushed over the flat area of the ridge. To lock the cap in place, the cap will be pushed and twisted so that it seals the sampler.
6. The capped sampler will be removed by depressing the locking lever on the T-handle while twisting and pulling the sampler from the T-handle.
7. This procedure will be performed until the appropriate amount of En Core samples are collected for each sample. For matrix spike (MS)/matrix spike duplicate (MSD) analyses, three additional En Core samples each are required (total of six En Core samples). In addition, sufficient soil sample must be collected in a glass jar or sleeve to allow percent moisture determination for VOC analyses at the laboratory.

8. The three En Core samples will be placed in its foil bag and sealed. The sample label on the outside of the bag will be completed and clear tape will be placed over the label. The foil bag will be placed in a resealable bag, a signed custody seal will be placed over that bag, the bag will be placed in another resealable bag, and then placed immediately on ice as described in Sections 6.7 and 6.9.

6.4 BACKFILL MATERIAL SAMPLING PROCEDURES

For verification sampling of import materials, backfill samples will be collected. If the site where the backfill is being imported from is accessible, then samples will be collected from the site; if the site is not accessible, then a sample of the material will be sent to our project site, and samples will be collected.

1. A hand-auger or similar device will be used to access and collect each sample.
2. Grab samples will be collected into sample jars. Sample jars will be filled completely to minimize headspace.
3. En Core samples for VOC analysis will be collected as described in Section 6.3.3.
4. Sample numbering, labeling, packaging and documentation procedures will be followed as described in Section 6.6 to Section 6.10.

6.5 DECONTAMINATION PROCEDURES

Decontamination of non-disposable sampling equipment will be performed prior to sampling and in between sample locations to prevent the introduction of extraneous material into samples and to prevent cross-contamination between samples. All sampling equipment will be decontaminated by steam cleaning or by washing with a nonphosphate detergent, such as Liquinox™, or equivalent. Decontamination water will be collected in 55-gallon DOT-approved drums or a poly-tank.

The following procedures will be used for decontamination of non-disposable sampling equipment:

1. **Wash with nonphosphate detergent and water solution**—This step will remove all visible contamination from the equipment. A suitable-size bucket filled with cleaning solution and a long-handled brush is suggested for this step. Dilute nonphosphate detergent as directed by the manufacturer.
2. **Rinse with potable water**—This step will rinse all the detergent solution away from equipment. A suitable-size bucket filled with water and a long-handled brush is suggested for this step. Periodic changing of this water is required. Perform this rinse twice.

3. **Rinse with deionized water**—This step will include double rinsing to remove detergent solution and potable water residues. Rinsing is most effective when water is applied using a stainless steel Hudson-type sprayer or Nalgene[®] squeeze bottle while holding equipment over a suitable-size bucket.

If equipment rinsate samples are to be collected, laboratory reagent-grade water will be used as an additional rinse after Step 3. Water that is falling off the sampling equipment (bailer and so forth) as it is being rinsed will be collected in appropriate sample bottles and analyzed for the same parameters as the field samples.

6.6 SAMPLE NUMBER

Samples will be uniquely designated using a numbering system that identifies the Contract Task Order (CTO) number, the site number, and a sequential number (i.e., 003-1441-001).

The sample number will be recorded in the field logbook, on the labels, and COC record at the time of sample collection. A complete description of the sample and sampling conditions will be recorded in the field logbook and referenced using the unique sample identification number.

6.7 SAMPLE LABELING

Sample labels will be filled out in indelible black or blue ink and affixed to sample containers at the time of sample collection. Each sample label will be covered with clear tape. Each sample container will be labeled with the following, at a minimum:

- Sample identification number
- Sample collection date (month/day/year)
- Time of collection (24-hour clock)
- Sampler's initials
- Analyses required
- Preservative (if any)

6.8 SAMPLE CUSTODY

An overriding consideration for data resulting from laboratory analyses is the ability to demonstrate that the data are legally defensible, i.e., that the samples were obtained from the locations stated and that they reached the laboratory without alteration. To accomplish this, evidence of collection, shipment, laboratory receipt, and laboratory custody until disposal will be documented through the COC record.

A sample is considered to be in custody if the following conditions have been observed:

- In actual possession or in view of the person who collected the samples
- Locked in a secure area

- Placed in an area restricted to authorized personnel
- Placed in a container and secured with an official seal, such that the sample cannot be reached without breaking the seal

The COC record lists each sample and the individuals performing the sample collection, shipment, and receipt.

Sample custody will be the responsibility of a SES-TECH on-site designee from the time of sample collection until the samples are accepted by a courier service for delivery to an off-site laboratory. Thereafter, the laboratory performing the analysis will maintain custody.

The COC record will be the controlling document to ensure that sample custody is maintained. Sampling personnel upon collecting a sample will initiate the COC record in the field.

Each time the sample custody is transferred, the former custodian will sign the COC on the “Relinquished By” line, and the new custodian will sign the COC on the “Received By” line. The date, time, and the name of their project or company affiliation will accompany each signature.

The waybill number or courier name will be recorded on the COC when a commercial carrier is used. The shipping container will be secured with two custody seals, thereby allowing for custody to be maintained by the shipping personnel until receipt of the laboratory.

In addition to providing a custody exchange record for the samples, the COC record serves as a formal request for sample analyses. The COC records will be completed, signed, and distributed as follows:

- The original (and a copy) sent to the analytical laboratory with the sample shipment
- One copy retained on site for inclusion in the project files
- One copy sent to the SES-TECH Project Chemist

At a minimum, the following items will be recorded on the COC record:

- Project name
- Project location/Site ID
- Project number
- Purchase order number
- Sample ID
- Sampler name
- Sampler signature
- Project contact

- Airbill number (if applicable)
- Date (of sample collection)
- Time (of sample collection to the nearest minute, 24-hour clock)
- Sample type (matrix)
- Turnaround time
- Sample location codes:

Examples:

confirmation soil samples:	<i>Site name</i> -SIDEWALL
	<i>Site name</i> -FLOOR
backfill:	<i>Site name</i> -BACKFILL
stockpile samples:	<i>Site name</i> -STOCKPILE
water samples:	<i>Site name</i> -MW#
equipment rinsate:	<i>Site name</i> -EQ RINSATE
drum samples:	<i>Site name</i> -D1

- Sample depth in feet (start, end)
- QC type:

REG:	regular sample
TB:	trip blank
FD:	field duplicate
ER:	equipment rinsate
SMQC:	source blank

- Composite description (if applicable)
- Laboratory name
- Number of sample containers
- Laboratory ID
- Analyses required
- Comments
 - Matrix spike/matrix spike duplicate (MS/MSD) samples
 - Observations specific to sample
 - Electronic data format (EDF), if required
- Transfer signature (to relinquish samples)
 - The sampler will be the first person to relinquish sample possession
- Courier/laboratory representative signature (for commercial carrier, record airbill number here)

- Date/time (of custody transfer)
- Laboratory instructions
- Data package requirement (Level III or IV)

6.9 SAMPLE PACKAGING AND SHIPMENT

Immediately after sample labeling, custody seals will be affixed to each sample container. For VOA vials, the custody seal will be placed on the outside of the first resealable bag; then the container will be placed in a second resealable bag. This will prevent any contact with the adhesive from the custody seal and the sample. Other sample containers will be placed in double-resealable plastic bags to protect the sample from moisture and to prevent breakage and potential cross-contamination during transportation to the laboratory. All glass sample containers will be protected with bubble wrap first if transported by a commercial carrier. VOA vials should be wrapped with bubble wrap, then placed in a resealable bag, a custody seal placed over the bag, and then placed in another resealable bag.

Each cooler will be shipped with a temperature blank. A temperature blank is a vial filled with tap water and stored in the cooler during sample collection and transportation. The temperature of the cooler will be recorded by the laboratory on the COC record immediately upon receipt of the samples.

Sample cooler drain spouts will be taped from the inside and outside of the cooler to prevent any leakage.

Samples transported by a laboratory-assigned courier will be packed in a sample cooler with sufficient ice to keep the samples cooled. Two custody seals will be taped across the cooler lid: one seal in the front and one seal in the back. The COC record will be completed and signed by the courier. The cooler and the top two copies (white and pink) of the COC record will then be released to the courier for transportation to the laboratory.

Samples to be shipped by commercial carrier will be packed in a sample cooler lined with a plastic bag. Double-bagged ice will be added inside the plastic bag at the bottom of the cooler, one layer of sample containers will be placed on the ice, and more double-bagged ice will be placed on top of the containers. This will be repeated until the cooler is filled with ice as the top layer in the cooler. The COC record will include the airbill number, and the “Received By” box will be labeled with the commercial courier’s name. The top two copies of the COC record will be sealed in a double-resealable bag and then taped to the inside of the sample cooler lid. The cooler will be taped shut with strapping tape. Two custody seals will be taped across the cooler lid: one seal in the front and one seal in the back. Clear tape will be applied to the custody seals to prevent accidental breakage during shipment. The pouch for the airbill will be placed on the cooler and secured with clear tape. The airbill will be completed for priority overnight delivery and placed in the pouch. If multiple coolers are being shipped, then the original airbill will be

placed on the cooler with the COC record, and copies of the airbill will be placed on the other coolers. The number of packages should be included on each airbill (1 of 2, 2 of 2). Saturday deliveries should be coordinated with the laboratory in advance, and field sampling personnel or their designee must ensure that Saturday delivery stickers are placed on each cooler by the commercial courier. "Dangerous goods" declarations will also be completed as applicable.

6.10 FIELD DOCUMENTATION AND RECORDS

In order to maintain the integrity and traceability of samples, all information pertinent to field sampling will be recorded in a field logbook. All samples will be properly labeled and custody-sealed prior to being transported to the laboratory and will be accompanied by completed COC documentation. All documentation will be recorded in indelible black or blue ink.

6.10.1 Chain-of-Custody

To establish the documentation necessary to trace sample possession from the time of collection through analysis and disposal, a COC record will be completely filled out and will accompany every sample. Samples will be delivered to the laboratory for analysis as soon as practicable. A COC record will accompany all samples. COC record will be completed as described in Section 6.6.

6.10.2 Custody Seals

Sample custody seals are used to detect unauthorized tampering of samples from the time of sample collection to the time of analysis. The seals will be signed or initialed and dated by the sampler. The seals will be placed on the sample containers and shipping containers in such a way that they must be broken in order to open the containers. Seals will be affixed to containers before the samples leave the custody of the sampling personnel.

6.10.3 Field Logbooks

A permanently bound field logbook with consecutively numbered pages, used for sampling activities only, will be assigned to this project. All entries will be recorded in indelible black or blue ink. At the end of each workday, the logbook pages will be signed by the responsible sampler and any unused portions of the logbook pages will be crossed out, signed, and dated.

If it is necessary to transfer the logbook to another person, the person relinquishing the logbook will sign and date the last page used and the person receiving the logbook will sign and date the next page to be used.

At a minimum, the logbook will contain the following information:

- Project name and site location
- Date and time

- Personnel in attendance
- General weather information
- Work performed
- Field observations
- Sampling performed, including specifics such as location, type of sample, type of analyses, and sample identification
- Field analyses performed, including results, instrument checks, problems, and calibration records for field instruments
- Descriptions of deviations from the CDQMP or this SAP
- Problems encountered and corrective action taken
- Identification of field QC samples
- QC activities
- Verbal or written instructions
- Any other events that may affect the samples

6.10.4 Document Corrections

Changes or corrections on any project documentation will be made by crossing out the erroneous item with a single line, initialing by the person performing the correction, and dating the correction. The original item, although erroneous, must remain legible beneath the cross-out line. The new information should be written clearly above the crossed-out item. Corrections will be written clearly and legibly with indelible black or blue ink.

7.0 PROJECT ORGANIZATION

This section identifies the key individuals from DON and SES-TECH who are responsible for the oversight and/or implementation of the proposed field activities. The project organization chart is shown in Figure A.7-1. The responsibilities of the team members associated with the sampling activities are presented in Table A.7-1.

7.1 LIST OF POINTS OF CONTACT

The following is a list of the key contacts for the project:

Agency	Contact	Title
Naval Facilities Engineering Command, Southwest (NAVFAC SW) 1220 Pacific Highway San Diego, CA 92132-5190	Mr. Bipin Patel (619) 532-4814	Remedial Project Manager
NAVFAC SW 1220 Pacific Highway San Diego, CA 92132-5190	Mr. Narciso Ancog (619) 532-3046	Quality Assurance Officer
MCB Camp Pendleton ROICC Office Building 22101 Camp Pendleton, CA 92055-5229	Mr. Yusuf Abdul-Rashad (760) 725-3399	Naval Technical Representative/ Resident Officer in Charge of Construction
SES-TECH 18000 International Boulevard, Suite 1009 Seattle, WA 98188	Mr. Mark Cutler (949) 756-7526	Project Manager
SES-TECH 18000 International Boulevard, Suite 1009 Seattle, WA 98188	Ms. Lisa Bienkowski (949) 756-7592	Program Chemist
SES-TECH 18000 International Boulevard, Suite 1009 Seattle, WA 98188	Ms. Mary Schneider (949) 756-7586	Quality Control Program Manager
SES-TECH 18000 International Boulevard, Suite 1009 Seattle, WA 98188	Ms. Sevda Aleckson (949) 756-7549	Project Chemist

8.0 QUALITY ASSURANCE OBJECTIVES

Managing the quality of data requires that objectives be established for the data as a basis against which the quality can be assessed. This section describes the DQOs process, analytical data quality objectives and indicators, and analytical method requirements.

8.1 DATA QUALITY OBJECTIVES

The DQOs specify the project objectives, the data collection boundaries and limitations, the most appropriate type of data to collect, and the level of decision error that will be acceptable for the decision. The quality and quantity of data required to implement environmental remedial action are also defined. The scope, level of detail, and verification for the design and planning documents may vary from project to project, depending on the project-specific conditions and the nature and complexity of the proposed activities. The project-specific DQOs as defined through the seven-step process (EPA, 2000) are as follows:

1. State the problem.
2. Identify the decision.
3. Identify inputs to the decisions.
4. Define the boundaries.
5. Develop a decision rule.
6. Specify the limits on decisions errors.
7. Optimize the sampling design.

The DQOs are presented in Table A.8-1.

8.2 ANALYTICAL DATA QUALITY OBJECTIVES

A laboratory with appropriate capabilities and accreditation will produce analytical data required for the project using approved methods of analysis. This section describes laboratory qualification, sample custody and documentation, QC procedures, QC samples, and preventative maintenance for the laboratories.

8.2.1 Laboratory Qualifications

The off-site laboratory that will provide analytical services for this project will be State of California Department of Health Services (DHS) Environmental Laboratory Accreditation Program (ELAP) certified analytical laboratories. All off-site environmental analytical laboratories would have successfully completed the Naval Facilities Engineering Service Center (NFESC) Laboratory Evaluation Program. Any deviations from these requirements will require

approval of the QA Officer. QA personnel for the laboratory will be designated in each laboratory's QA Manual. The analytical laboratory will designate a Project Manager for this project.

Laboratories selected for the project must be capable of providing the project QC samples and data deliverables required by this SAP.

8.2.2 Laboratory Sample Custody and Documentation

The integrity and traceability of samples from the time they are collected through the time data are reported are essential in any sampling and analysis program. The handling of the samples and transferring of custody must be well-documented given the evidentiary nature of the analytical data. A sample is considered to be in one's custody if it meets any of the following criteria listed in Section 6.6.

The samples will be delivered to the person in the laboratory authorized to receive samples (referred to as the sample custodian). Upon receipt of a sample, the sample custodian will inspect the condition of the sample (including the temperature of the cooler as applicable) and the custody seal, reconcile the information on the sample label against that on the COC record, assign a unique laboratory tracking number, log the sample in the laboratory logbook, and store the sample in a secured sample storage room.

If the laboratory sample custodian judges sample custody to be invalid (e.g., custody seals have been broken), the laboratory will initiate a Nonconformance Report (NCR). SES-TECH personnel will be immediately notified of this event. SES-TECH will make a decision, in consultation with the client, as to the fate of the sample(s) in question on a case-by-case basis. The sample(s) will either be processed "as-is" with custody failure noted along with the analytical data, or rejected with resampling scheduled, if necessary. The nonconformance associated with the samples will be noted on the appropriate certificate or analysis or case history.

The laboratory will initiate an internal COC that will track the sample within the various areas of the laboratory. The relinquishing signature of the sample custodian and the custody acceptance signature of the laboratory personnel transfer custody of the sample. This procedure is followed each time a sample changes hands. The laboratory will archive the samples and maintain their custody as required by the contract or until further notification from SES-TECH, at which time, the samples will either be returned to the project for disposal or disposed of by the laboratory.

8.2.3 Laboratory Quality Control Procedures

The analytical laboratory will have written standard operating procedures (SOPs) defining the instrument operation and maintenance, tuning, calibration, Method Detection Limit (MDL) determination, QC acceptance criteria, blank requirements, and stepwise procedures for each

analytical method. At a minimum, SOPs will be written for the following procedures and methods: sample receipt/control/disposal, sample preparation/extraction, sample analysis, result calculation, database management, health and safety, and corrective action. The SOPs and all revisions will be available to the analysts in the laboratory. The SOPs must meet or exceed the requirements of the analytical methods and the *Quality Systems Manual for Environmental Laboratories* [Department of Defense (DoD), 2000]. The laboratory must maintain logs of all activities that have an impact on the quality of the laboratory results.

Any portion of the method that is subcontracted by the laboratory to another laboratory or sent to another facility of the same network of laboratories must have the prior approval of the SES-TECH Project Chemist.

The laboratory must maintain the instruments in working condition required by the methods specified for the analyses. Sufficient redundancy in equipment must be available in the laboratory to handle downtime situations. Method substitution because of instrumental failure will not be permitted without approval from the SES-TECH Project Chemist.

8.2.4 Laboratory Quality Control Checks

The following subsections describe in detail the laboratory QC checks required by this project.

8.2.4.1 Calibration

All instruments will be calibrated and the calibration acceptance criteria met before samples are analyzed. Calibration standards will be prepared with National Institute for Standards and Testing (NIST)-traceable standards and analyzed per methods requirements. Initial calibration (ICAL) acceptance criteria documented in the laboratory SOPs will meet those of applicable guidance documents. The ICAL will meet the following requirements:

- The lowest concentration of the calibration standard is less than or equal to the reporting limit (RL) based on the final volume of extract or sample.
- For each target analyte, at least one of the calibration standards will be at or below the regulatory limit (action level) as defined by the DQOs.
- Before samples are analyzed, initial calibration will be verified with a second source standard prepared at the mid-point of the calibration curve. ICAL verification will meet the acceptance criteria which are expressed in the laboratory SOPs.
- Daily calibration verification will be conducted at the method-prescribed frequencies, and will meet the acceptance criteria of applicable guidance documents. Daily calibration verification will not be used for quantitation of target analytes.
- Calibration data (calibration tables, chromatograms, instrument printouts, and laboratory logbooks) will be clearly labeled to identify the source and preparation of the calibration standard and therefore, be traceable to the standard preparation records.

8.2.4.2 Instrument Blanks

An instrument blank is used to monitor the cleanliness of the instrument system during sample analysis. Instrument blanks are solvent or acid solutions of the standard used to calibrate the instrument. During metals analyses, one instrument blank is usually analyzed for every ten samples. For gas chromatograph (GC)/mass spectrometer (MS) analysis, instrument blanks are analyzed on an as-needed basis for troubleshooting and chromatography column carryover determination.

8.2.4.3 Method Blanks

Method blanks are prepared in the same manner as the samples, using the same reagents and glassware used for samples. The purpose of the method blank is to ensure that the equipment and reagents used in preparing the samples are free of contaminants that could interfere with the analysis. The method blank must be prepared and analyzed for each batch of 20 project samples or less per matrix (aqueous and solid) type.

The method blank must not exhibit analytes at concentrations greater than half the required RLs. If contaminants are found that either contribute to the apparent concentration of a particular target analyte or interfere with the analysis, the analysis must be stopped, the source of contamination identified and corrected, and the analysis repeated. Contamination in the method blank above half the RLs will require that the entire associated batch of extracts or digestates be reprepared and reanalyzed. Hence, it is very important to make sure that no such contamination is present.

Some methods of inorganic analysis do not have a distinctive preparation step. For these tests, an instrument blank, which contains all reagents used with samples, is considered to be the method blank.

8.2.4.4 Laboratory Control Samples

Laboratory control samples are matrix equivalent QC check samples (analyte-free water, laboratory sand, or sodium sulfate) spiked with a known quantity of specific analytes that are carried through the entire sample preparation and analysis process. The spiking solution used for laboratory control samples (LCS)/laboratory control sample duplicate (LCSD) preparation is of a source different from the stock that was used to prepare calibration standards.

The LCS is prepared and run at a frequency of one per 20 project samples per matrix with the associated samples, using the same reagents and volumes. If insufficient quantity of sample is available for the MS/MSD, the LCS will be prepared and analyzed in duplicates.

8.2.4.5 Laboratory Duplicates

For laboratory sample duplicate analyses, a sample is prepared and analyzed twice. Laboratory sample duplicates are prepared and analyzed with each batch of samples for most inorganic analyses.

8.2.4.6 Matrix Spikes

Matrix spikes (MSs) are QC check samples that measure matrix-specific method performance. MSs are only applicable to the off-site laboratory. A MS sample is prepared by adding a known quantity of target analytes to a sample prior to sample digestion or extraction. In general, for organic compound and metal analyses, an MS/matrix spike duplicate (MSD) pair is prepared and analyzed with each preparation batch or for every 20 samples. For inorganic compound analysis, a single MS and a laboratory sample duplicate are often prepared and analyzed with each batch. The MS results allow verifying the presence of matrix effects.

8.2.4.7 Surrogate Standards

Organic compound analyses include the addition, quantitation, and recovery calculation of surrogate standards. Compounds selected to serve as surrogate standards must meet all of the following requirements:

- Are not the target analytes
- Do not interfere with the determination of target analytes
- Are not naturally occurring, yet are chemically similar to the target analytes
- Are compounds exhibiting similar response to target analytes

Surrogate standards are added to every analytical and QC check sample at the beginning of the sample preparation. The surrogate standard recovery is used to monitor matrix effects and losses during sample preparation. Surrogate standard control criteria are applied to all analytical and QC check samples, and if surrogate criteria are not met, re-extraction and reanalysis may be performed.

8.2.4.8 Internal Standards

Some organic compound analyses include the addition, quantitation, and recovery calculation of internal standards. Internal standards are usually synthetic compounds, which are similar in chemical behavior to the target analytes. They are added to sample extracts at the time of instrument analysis, and are used to quantify results through internal standards calibration procedure. Internal standard recoveries are used to correct for injection and detector variability. GC/MS must use internal standards and have specific acceptability limits for internal standard areas. Use of internal standard quantitation for GC methods is optional.

8.2.4.9 Post-digestion Spikes and the Method of Standard Addition

A post-digestion spike is used during metal analysis to assess analytical interferences that may be caused by general matrix effects or high concentrations of analytes present in the sample. A digested sample is spiked with the analyte of interest at a known concentration, and the spike recovery is used to estimate the presence and the magnitude of interferences.

If a post-digestion spike recovery fails to meet acceptance criteria, the Method of Standard Addition (MSA) will be used to quantify the sample result. The MSA technique compensates for a sample constituent that enhances or depresses the analyte signal. To perform the MSA, known amounts of a standard at different concentrations are added to aliquots of digested sample, and each spiked sample and the original unspiked sample are analyzed. The absorbance is then plotted against the concentration, and the resulting line is extrapolated to zero absorbance. The point of interception with the concentration axis is the indigenous concentration of the analyte in the sample.

8.2.4.10 Preventative Maintenance

All instruments must be maintained in accordance with the manufacturers' recommended procedures. The laboratory must define in its QA plan the frequency and type of maintenance for each instrument. The laboratory must also record all maintenance activities in an instrument logbook.

In addition to preventive maintenance, the laboratory must keep a sufficient supply of replacement parts on hand for those parts known to require frequent changes due to wear and tear or contamination.

Whenever preventive or corrective maintenance is applied to an instrument, the laboratory must demonstrate the instrument's return to operating conditions and must recalibrate the instrument prior to resumption of sample analyses.

8.3 DATA QUALITY INDICATORS

Analytical DQOs will be assessed through application of precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters discussed in this section. Proposed QC acceptance limits for precision and accuracy for this project are presented in Table A.8-3.

8.3.1 Precision

Precision is the measure of the reproducibility of a set of replicate results or the agreement among repeat observations made under the same conditions. Analytical precision is the measurement of the variability associated with duplicate or replicate analyses. For a project, a LCS will be used to determine the precision of the analytical method. Total precision is the measurement of the variability associated with the entire sampling and analysis process. It is

determined by analysis of duplicate field samples and measures variability introduced by both the laboratory and field operations. Field duplicate, laboratory duplicate, and MSD samples will be used to assess field and analytical precision, and the precision measurement will be determined using the relative percent difference (RPD) between the duplicate sample results. The formula for calculating the RPD is as follows:

$$RPD = 100 \times 2 \times (\text{result} - \text{duplicate result}) / (\text{result} + \text{duplicate result})$$

The analytical laboratory will have statistically based acceptability limits for RPDs established for each method of analysis and sample matrix. These statistically based acceptability limits are called control limits.

The laboratory will review the QC sample data to ensure that internal QC data lies within the control limits. Control limits are defined as the mean recovery, plus-or-minus three standard deviations, of the 20 data points, with the warning limits set as the mean plus-or-minus two standard deviations. Any suspect trends will be investigated and corrective actions taken. The analytical precision acceptability limits for a project will be as follows:

LCS/LCD

Soil: 20% for metals and 30% for all other analyses
Water: 20% for all analyses

MS/MSD

Soil: 50% for all analysis
Water: 30% for all analysis

8.3.2 Accuracy

Accuracy is defined as the nearness of a result or the mean of a set of results to the true or accepted value. Analytical accuracy is measured by comparing the percent recovery of analytes spiked into a sample against a control limit. Percent recoveries for MS, MSD, and LCS that are analyzed for every batch of up to 20 samples serve as a measure of analytical accuracy. Surrogate standards are added to all field samples, blanks, MS, MSD, and LCS analyzed for organic contaminants to evaluate the method's accuracy and help to determine matrix interferences. The formula for calculating accuracy uses the following equation to determine percent recovery (%R) of specific analytes.

$$\%R = 100 \times (\text{spiked sample result} - \text{unspiked sample result}) / \text{amount of spike added}$$

The spiking solutions used for accuracy determinations are not used for instrument calibrations.

As a general rule, the recovery of most compounds spiked into samples is expected to fall within a range of 70 to 130 percent. This range represents the EPA advisory acceptability limits for MS,

MSD, and LCS for all organic analysis methods. The surrogate standard advisory acceptability limits are also 70 to 130 percent for all organic analyses with the exception of GC/MS methods, where these limits are specified in the methods for each matrix. EPA SW-846 mandates the recovery acceptance limits for metal analysis at 75 to 125 percent.

The laboratory will review the QC samples and surrogate standard recoveries for each analysis to ensure that internal QC data lay within the control limits of acceptability. The laboratory will investigate any suspect trends and take appropriate corrective actions according to internal laboratory procedures.

8.3.3 Representativeness

Unlike precision and accuracy, which can be expressed in quantitative terms, representativeness is a qualitative parameter. Representativeness is the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. It is a qualitative parameter that depends on proper design of the sampling program.

Field personnel will be responsible for ensuring that samples are representative of field conditions by collecting and handling samples according to the approved CDQMP and this SAP. Errors in sample collection, packaging, preservation, or COC procedures may result in samples being judged non-representative and may form a basis for rejecting the data.

Data generated by the laboratory must be representative of the laboratory database of accuracy and precision measurements for analytes in different matrices. Laboratory procedures for sample preparation will ensure that aliquots used for analysis are representative of the whole sample. Aliquots to be analyzed for volatile parameters will be removed before the laboratory composites/homogenizes the samples, to avoid losing volatile compounds during mixing.

8.3.4 Completeness

Completeness is the percentage of measurements made that is judged to be valid. The completeness goal is to generate a sufficient amount of valid data to meet project needs. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not qualified with a rejected ("R") flag. The requirement of completeness is 90 percent for gas samples, 95 percent for aqueous samples, and 90 percent for soil samples and is determined using the following equation:

$$\% \text{ completeness} = 100 \times (\text{number of valid analyte results} / \text{number of possible results})$$

8.3.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another, whether it was generated by a single laboratory or during interlaboratory studies. The use of standardized field and analytical procedures ensures comparability of analytical data.

Sample collection and handling procedures will adhere to EPA-approved protocols. Laboratory procedures will follow standard analytical protocols, use standard units, standardized report formats, follow the calculations as referenced in approved analytical methods, and use a standard statistical approach for QC measurements.

8.4 PROPOSED REPORTING LIMITS

The laboratory will determine the MDLs for each method, instrument, analyte and matrix by using the procedure described in 40 Code of Federal Regulations (CFR) Part 136, Appendix B. The MDL is defined as the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero.

An MDL study involves preparation/digestion and analysis of seven replicates of a given matrix spiked with target analytes at concentrations two to five times greater than the estimated MDL. At a minimum, the laboratory will conduct annual MDL studies.

Proposed RLs for this project are presented in Table A.8-2. These limits may be elevated for individual samples if matrix interferences are encountered, or may be altered based on analytical laboratory capabilities.

9.0 DATA MANAGEMENT

9.1 LABORATORY DATA REVIEW

All data reported by the laboratory must be reviewed in accordance with the SOPs and as described in the following subsections.

9.1.1 Analyst Review

Each analyst that generates a data set is responsible for ensuring that 100 percent of the data comply with the method- and project-specific requirements and that any deviations or failure to meet criteria are documented for the project file.

9.1.2 Peer Review

One hundred percent of all data sets must be reviewed by an independent peer analyst. Peer reviews must be performed by an analyst that is qualified to perform the subject analytical method. The peer review must be comprehensive and include the following:

- Check 100 percent of manual entries for transcription errors
- Check 100 percent of manual calculations for accuracy
- Spot-check computer calculations to verify program validity
- Check for compliance with method- and project-specific QC requirements
- Check for completeness of raw data or supporting materials
- Confirm spectral assignments
- Check descriptions of deviations from method or project requirements
- Check for appropriate use of significant figures and rounding
- Check reported values for dilutions
- Evaluate reasonableness of results

9.1.3 Technical Review

Technical reviews by the responsible supervisor or designated alternate must be performed on 100 percent of reported data. The same individual may not perform peer and technical reviews on the same data set. The technical review must include the following:

- Check for compliance with method- and project-specific requirements
- Check the completeness of the reported information
- Check the information in the report narrative
- Evaluate the reasonableness of the results

If the responsible supervisor is the only qualified peer reviewer for a method, the requirement for the technical review is waived.

9.1.4 Management Review

One hundred percent of all data must receive management approval prior to release. The scope and content of management's review is at the laboratory's discretion. Authority to release data may be delegated to a technical supervisor or other party, if the term of the delegated authority is documented in the QA program file.

9.1.5 Quality Assurance Review

QA reviews of data from each section of the laboratory must be conducted on a routine basis. Annually, at least 10 percent of data reports generated using each analytical method must be reviewed by a member of the QA staff. The QA reviews must include the following:

- Check for compliance with required QC practices
- Check for compliance with approved SOPs
- Check for compliance with method and project requirements

QA data reviews may be conducted after the subject data have been reported to SES-TECH.

9.2 LABORATORY DATA DELIVERABLES

The following sections describe the deliverable documents that will be submitted to SES-TECH by the analytical laboratory.

9.2.1 Hard-copy Report

All relevant raw data and documentation, including, but not limited to, logbooks, data sheets, electronic files, and final reports, will be maintained by the laboratory for at least 7 years. SES-TECH will be notified 30 days before disposal of any relevant laboratory records.

SES-TECH will maintain copies of all COC records. Laboratory reports will be logged in upon receipt and filed in chronological order.

Two copies of the hard-copy data will be submitted to SES-TECH by the laboratory. The report pages will be sequentially numbered. The report will contain a table of contents referencing individual sections in the data package, an original copy of COC records, a copy of all corrective action reports, and a narrative documenting the resolution of all corrective actions and nonconformances. All SES-TECH samples will be cross-referenced to the associated QC samples. When revisions to data reports are required, the revised pages will be stamped with the notation "amended or revised report."

For waste characterization samples, 100 percent of the data will be submitted in an EPA Level III-equivalent data package. All data packages will be assembled in the following sequence:

- Cover page (with laboratory service identification number, SES-TECH project name, and SES-TECH project number)
- Original COC records (including cooler temperature and sample condition)
- Sample receipt forms
- Cross-reference table
- Case narrative
- Organic raw data sequence (by test):
 - Sample result forms, including method blanks
 - Sample raw data after each result form (EPA Level IV only)
 - Surrogate summaries (surrogate results may appear on the sample result forms)
 - QC summaries
 - Tune data (GC/MS only)
 - ICAL
 - Daily calibration checks, including related continuing calibration verifications (CCVs)
 - Resolution check standards (GC/MS and pesticides) (if applicable)
 - QC (LCS, MS/MSD) raw data (EPA Level IV only)
 - Instrument run log
 - Sample preparation log
- Inorganic raw data sequence:
 - Sample results forms, including method blanks
 - Sample raw data (EPA Level IV only)
 - QC summaries
 - ICAL
 - Daily calibration checks, including all related CCVs
 - Calibration blanks, including all related continuing calibration blanks
 - Interference check standards A and B for inductively coupled plasmas-atomic emission spectrometer (ICP-AES) only
 - QC (AS/LCS/MS/MSD) raw data (EPA Level IV only)
 - ICP-AES serial dilutions
 - Instrument run log
 - Sample preparation log

9.2.2 Electronic Data

The electronic data deliverable (EDD) will be in ASCII format. This will be compatible with the Naval Electronic Data Deliverable standard as described in *Environmental Work Instruction (EWI) EVR.6, Environmental Data Management and Required Electronic Delivery Standards* [Southwest Division, Naval Facilities Engineering command (NFECSW), 2005]. The laboratory will verify that the EDD and the hard-copy reports are identical. Both the EDD and the hard-copy report will present results to two or three significant figures. For organic results, two significant figures will be used for all results. For inorganic results, two significant figures will be used for results less than 10, and three significant figures will be used for results greater than 10. Results for QC analyses (method blanks, MS/MSD, LCS, and duplicates) will be reported up to three significant figures. The EDD for each sample delivery group is due at the same time as the hard-copy report, 21 calendar days after the last sample of the sample delivery group has been delivered to the laboratory.

In addition, the laboratory will submit data in the State Water Resources Control Board UST program "EDF." The laboratory will check all EDFs using the Electronic Data Consistency Checker (EDCC) software, which generates a report summarizing any errors/warnings found in the EDF. The report must be submitted along with the EDF, and must indicate zero errors in order for the EDF to be acceptable. "Warnings" may be acceptable in the report, but must be discussed in the EDCC documentation. If errors exist in the EDF, the laboratory must correct the errors and resubmit the EDF. A complete EDF submission includes a diskette containing the EDF files and a hard-copy EDCC report showing zero errors.

Field information (date and time collected, sample identification, and so forth) will be entered directly into a Microsoft database from the COC records or uploaded from electronic files generated in the field. Upon receipt by the SES-TECH Data Manager, electronic data will be uploaded into the database. The uploaded data will be processed to compare the fields against a list of required values. If any errors are returned by the program, the file will be manually edited or regenerated by the laboratory. The laboratory database will be merged with the field database, and reports will be generated from the merged database.

9.3 DATA VALIDATION

All sample data, with the exception of waste characterization samples, will be validated by an independent data validation company. Data will be validated at 90 percent EPA Level III and 10 percent EPA Level IV. The validation will be in accordance with the Contract Laboratory Program *National Functional Guidelines for Organic Data Review*, EPA 540/R-99-008 (EPA, 1999), Contract Laboratory Program *National Functional Guidelines for Inorganic Data Review*, EPA 540-R-04-004 (EPA, 2004), *Environmental Work Instruction (EWI) #1, 3EN2.1, Chemical Data Validation* (NFECSW, 2001a), and the QC criteria specified in the referenced methods and in this SAP. Data not meeting method and/or SAP specifications will be flagged as estimated ("J") or rejected ("R").

The data validation company will have the following qualifications:

1. A minimum of 5 years of experience in the environmental data validation business
2. Prior experience on DON Remedial Action Contract or Comprehensive Long-term Environmental Action projects
3. DON data validation experience
4. Active peer review program

Personnel must have the following qualifications:

1. Data Reviewer:
 - Bachelor of science degree or higher in chemistry or a physical science
 - 5 years of combined experience with approximately 2 years in data validation and 3 years conducting laboratory analysis in an environmental laboratory using the EPA-approved methods being validated
2. Peer Reviewer:
 - Bachelor of science degree or higher in chemistry or a physical science
 - 5 years of combined experience with approximately 2 years in data validation and 3 years conducting laboratory analysis in an environmental laboratory using the EPA-approved methods being validated

9.4 DATA EVALUATION

Following third-party validation, data will be further evaluated by the SES-TECH Project Chemist. During this process, the SES-TECH Project Chemist will determine which of the advisory data qualifiers provided by the independent data validator will be retained or removed. The evaluation of data will be based on method requirements and the results of the QC samples, the level of contamination of samples indicated by the method blanks analysis, and the overall indication of interference due to contamination. The following data qualifiers will be used in the report:

- J - Result is estimated
- U - Analyte is not detected at or above the stated RL
- R - Data are rejected
- UJ- Analyte is not detected, but there is an uncertainty about the RL

Data qualifying will be used to alert end users to uncertainties associated with the data. The evaluation flags will be entered into a special field in the electronic database. Thus, when data processing is complete, the data for each analyte will have the flag designated by the laboratory and the flag designated by the evaluator, as appropriate.

10.0 QUALITY ASSURANCE OVERSIGHT

QA oversight for this project will include system audits of field activities and of the laboratory subcontracted by the DON to perform the analysis.

10.1 FIELD AUDITS

The SES-TECH and NAVFAC SW QA Officers may schedule audits of field activities at any time to evaluate the execution of sample collection, identification, and control in the field. The audit will also include observations of COC procedures, field documentation, instrument calibrations, and field measurements.

Field documents and COC records will be reviewed to ensure that all entries are printed or written in indelible black or blue ink, dated, and signed.

Sampling operations will be reviewed and compared to the CDQMP and this SAP and other applicable SOPs. The auditor will verify that the proper sample containers are used, the preservatives are added or are already present in the container, and the documentation of the sampling operation is adequate.

Field measurements will be reviewed by random spot-checking to determine that the instrument is within calibration, the calibration is done at the appropriate frequency, and that the sensitivity range of the instrument is appropriate for the project.

10.1.1 Corrective Action

Nonconformance identified during the field audit will be recorded on a Nonconformance Report. All nonconformance and corrective actions will be processed in accordance with procedures in the *Final Contractor Quality Control Program Plan* (SES-TECH, 2005b).

The SES-TECH QC Program Manager will monitor corrective action documentation, verify implementation of the corrective action, track and analyze the corrective action, and close out corrective action documentation upon completion of the corrective action.

10.2 LABORATORY AUDITS

The laboratory selected to perform the analyses is required to have successful completion of the NFESC laboratory evaluation process throughout the project. This process consists of a laboratory QA plan review, performance evaluation samples, a data package review, and an on-site audit. Because of this requirement, SES-TECH will not perform an on-site audit or visit, unless it is deemed necessary.

Laboratory oversight by SES-TECH will include a thorough review of the preliminary report and hard-copy data packages. The information that may be obtained from the data packages consists of the following:

- Correctness of COC procedures
- Adherence to method holding times
- Project RLs
- Spiking levels, frequency, and recovery
- Accuracy of analytical methods through the LCSs and surrogates

10.2.1 Corrective Action

The laboratory will have a QA/QC and corrective action program that addresses all out-of-control situations. Following completion of analyses, laboratory personnel will verify compliance with the minimum QC requirements of the project and the laboratory QA/QC plan. If any of the parameters fall outside the control limits, corrective action will be implemented.

Initial corrective action is to verify that no obvious calculation errors have occurred. If appropriate, reanalysis will be performed. If the reanalysis confirms the initial out-of-control limits result, the chemist will notify the laboratory supervisor, who will initiate the corrective action process. Corrective actions may include, but are not limited to, the following:

- Verification of dilution factors
- Examination of sample for nonhomogeneity
- Verification of sample preparation
- Checking of standard preparation logbook
- Verification of instrument performance
- Checking of reagent-grade water purity
- Monitoring chemist's method performance for procedure verification

Notification and prompt involvement of the SES-TECH Project Chemist in the corrective action process are absolutely necessary in determining an appropriate resolution. Corrective action records will document all steps taken in the corrective action process, beginning with a description of the problem and ending with a final resolution. A copy of the corrective action report will be sent to the SES-TECH Project Chemist immediately and will be maintained in the project files at SES-TECH.

All corrective action reports will be maintained by the laboratory in a project file and delivered to the SES-TECH Project Chemist as part of the hard-copy deliverable.

11.0 SAP REVISION OR AMENDMENT

When circumstances arise that impact the original project DQOs, such as a significant change in work scope, this SAP will be revised or amended. The modification process will be based on EPA guidelines, direction from the DON and QA Officer, and will be in conjunction with *Environmental Work Instruction (EWI) #2, 3EN2.2, Review, Approval, Revision, and Amendment of Sampling and Analysis Plans (SAPs)* (NFECSW, 2001b).

12.0 REFERENCES

- Battelle Memorial Institute (Battelle). 1999. *Final Site Assessment Report for Former Underground Storage Tank Site 1441 at Marine Corps Base Camp Pendleton, Oceanside, California*. July.
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TABLES

TABLE A.5-1

**SAMPLE CONTAINERS, PRESERVATIVES,
AND HOLDING TIME REQUIREMENTS**

Analysis	Analytical Method	Container	Preservative	Holding Time
Soil				
TPH-d	EPA Method 3550B/8015B	Brass or stainless steel sleeve or 8-ounce glass jar	Cool, 4±2°C	14 days to extraction and 40 days to analyze
SPLP/TPH-d	EPA Method 1312/8015B ^a	Brass or stainless steel sleeve or 8-ounce glass jar	Cool, 4±2°C	14 days to SPLP, 7 days to method extraction, and 40 days to analyze
VOCs	EPA Method 5035/8260B ^b	Three En Core™ samplers	Cool, 4±2°C	48 hours for analysis or lab preservation for En Core samplers; analysis within 14 days of preservation
SPLP/VOCs	EPA Method 1312/8260B ^a	Brass or stainless steel sleeve or 8-ounce glass jar	Cool, 4±2°C	14 days to SPLP and 14 days to analyze
PAHs	EPA Method 3550B/8270C SIM or 3550B/8310	Brass or stainless steel sleeve or 8-ounce glass jar	Cool, 4±2°C	14 days to extraction and 40 days to analyze
SPLP/PAHs	EPA Method 1312/8270C SIM ^a or 1312/8310	Brass or stainless steel sleeve or 8-ounce glass jar	Cool, 4±2°C	14 days to SPLP, 7 days to method extraction, and 40 days to analyze
Title 22 Metals	EPA Method 3050B/6010B/7471A	Stainless steel sleeve or 8-ounce glass jar	Cool, 4±2°C	180 days to analyze, except for mercury, which is 28 days
pH	EPA Method 9045C	Brass or stainless steel sleeve or 8-ounce glass jar	Cool, 4±2°C	Analyze immediately upon receipt at laboratory
Water				
TPH-d	EPA Method 3520C/8015B	Two 1-L glass ambers	Cool, 4±2°C	7 days to extraction and 40 days to analyze
VOCs	EPA Method 5030B/8260B	Three 40-mL VOA vials	Cool, 4±2°C, pH ≤ 2 w/ HCl	14 days
PAHs	EPA Method 3520C/8270C SIM or 3520C/8310	Two 1-L glass ambers	Cool, 4±2°C	7 days to extraction and 40 days to analyze
Nitrate	EPA Method 300.0	One 250-mL HDPE	Cool, 4±2°C	48 Hours
Sulfate	EPA Method 300.0	One 250-mL HDPE	Cool, 4±2°C	28 days

TABLE A.5-1**SAMPLE CONTAINERS, PRESERVATIVES,
AND HOLDING TIME REQUIREMENTS****Notes:**

^a EPA Method 1312 is for SPLP.

^b EPA Method 5035 will be performed for soil/waste VOC samples only and not for SPLP/VOCs.

°C – degrees Celsius

EPA – U.S. Environmental Protection Agency

HCl – hydrochloric acid

L – liter

mL – milliliter

HDPE – high density polyethylene

PAH – polynuclear aromatic hydrocarbon

SIM – Selective Ion Monitoring

SPLP – Synthetic Precipitation Leaching Procedure

TPH-d – total petroleum hydrocarbons quantified as diesel

VOA – volatile organic analysis

VOC – volatile organic compound

TABLE A.7-1
PERSONNEL AND RESPONSIBILITIES

Key Position	Responsibility
NFECSW QAO	<ul style="list-style-type: none"> • Provides governmental oversight of the SES-TECH QA Program • Provides quality-related directives through Contracting Officer Representative • Provides technical and administrative oversight of SES-TECH surveillance audit activities • Acts as point of contact for all matters concerning QA and the DON's Laboratory QA Program • Prepares governmental budget estimates for all QA functions included in SES-TECH contracts • Coordinates training on matters pertaining to generation and maintenance of quality of data • Authorizes the suspension of project execution if QA requirements are not adequately followed
QC Program Manager	<ul style="list-style-type: none"> • Reviews and approves the QCP and following revisions • Periodically evaluates the effectiveness of the QCP through conducting surveillances, audits, or management assessments • Assigns, directs and supports the PQCM and staff • Trains, qualifies, and evaluates the PQCM and staff project personnel according to the QCP • Reviews project-specific SAPs as required • Directs QA audits
Program Chemist	<ul style="list-style-type: none"> • Implements contract requirements for chemical data collection • Reviews project-specific SAPs as required • Serves as a point of contact for the NFECSW QAO • Audits field and laboratory performance as required • Approves the selection of subcontract analytical laboratories and data validation companies

TABLE A.7-1
PERSONNEL AND RESPONSIBILITIES

Key Position	Responsibility
Project Manager	<ul style="list-style-type: none"> Issues and authorizes, in conjunction with SES-TECH's QC Program Manager, Appointment Letters describing duties/responsibilities and delegating authority to the PQCM to act on the Project Manager's behalf for site-related quality activities Issues stop-work order when necessary Monitors and controls through audits and surveillance of project activities, ensuring that relevant portions of the plan are implemented Interfaces directly with the Client to maintain an awareness in planning and scheduling processes Establishes an overall records management system for the project that ensures clarity, completeness, retrievability, and conformance to contract requirements and ensures document security Implements the approved project-specific plans Evaluates project-specific procedures and plans Evaluates the project schedule and budget
Project Chemist	<ul style="list-style-type: none"> Develops project-specific SAPs Evaluates and selects qualified subcontract analytical laboratories and data validation companies Implements chemical data QC procedures Reviews laboratory data prior to use Coordinates data validation of laboratory data Reviews data validation reports Determines whether project specifications have been met Prepares and supports report preparation
Field Sampling Personnel	<ul style="list-style-type: none"> Performs all field sampling in accordance with the CDQMP and project-specific SAP Ensures that field QC samples are collected Completes field documentation Coordinates laboratory and field sampling activities Implements field corrective actions as required

TABLE A.7-1
PERSONNEL AND RESPONSIBILITIES

Notes:

CDQMP – Chemical Data Quality Management Plan
DON – Department of the Navy
NFEC SW – Southwest Division, Naval Facilities Engineering Command
PQCM – Project Quality Control Manager
QA – quality assurance
QAO – Quality Assurance Officer
QC – quality control
QCP – Quality Control Plan
SAP – Sampling and Analysis Plan
SES-TECH – Sealaska Environmental Services LLC and Tetra Tech FW, Inc.

TABLE A.8-1
SUMMARY OF DATA QUALITY OBJECTIVES

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7
Statement of Problem	Decisions	Inputs to the Decisions	Boundaries of the Study	Decision Rules	Limits on Decision Errors	Optimize the Sampling Design
<p>UST Site 1441 is an inactive former UST site in the 14 Area of the Base.</p> <p>Subsurface contaminants are the results of diesel fuel leaks from the former UST.</p> <p>The site requires one year of quarterly groundwater monitoring and soil excavation to ensure that residual fuel in soil does not leach above WQOs.</p>	<p>(1) Are the concentrations of leachable contaminants in the soil confirmation samples above or below the WQOs listed in Table A.8-2)?</p> <p>(2) Are the concentrations of the groundwater samples above or below the WQOs listed in Table A.8-2?</p> <p>(3) Does backfill material exceed or meet the action levels listed in Table A.8-2?</p>	<p>Data from previous site investigations conducted by Battelle (1999).</p> <p>Results of confirmation soil samples collected during this project that will be analyzed for:</p> <p style="padding-left: 20px;">TPH-d SPLP/TPH-d SPLP/VOCs SPLP/PAHs</p> <p>Results of groundwater samples analyzed for TPH-d, VOCs, PAHs, nitrate, and sulfate.</p> <p>Results of backfill material samples analyzed for Title 22 metals and pH.</p>	<p>UST Site 1441 is the focus of this project.</p> <p>Approximately 225 cubic yards of soil will be excavated.</p> <p>Confirmation soil samples will be collected from each sidewall and excavation bottom.</p> <p>One year of quarterly groundwater sampling will be collected.</p> <p>Backfill samples collected from quarry or selected vendor.</p> <p>Fieldwork is scheduled to begin in October 2005. Project closeout is scheduled for 2007.</p>	<p>(1) (a) If the confirmation samples contain leachable quantities of contaminants above action levels listed in Table A.8.2, then the soil will be over-excavated to the extent possible and samples will be recollected.</p> <p>(1) (b) If leachable concentrations of constituents in the soil confirmation samples are below the action levels listed in Table A.8.2, then the soil excavation/remediation will be considered successful and backfilling will commence.</p> <p>(2) (a) If any of the groundwater samples contain chemicals of concern above action levels listed in Table A.8-2, then the DON will be contacted to determine whether additional groundwater monitoring will be conducted.</p> <p>(2) (b) If all of the groundwater samples do not contain chemicals of concern above action levels listed in Table A.8-2, then a report recommending site closure</p>	<p>To limit decision errors, analytical method requirements and project-specific DQOs were established. Published analytical method and laboratory-specific performance requirements are the primary determinants of DQOs for precision and accuracy.</p> <p>Field crews will review the SAP before collection of samples. The laboratory performing the analysis will be given a copy of the SAP before analysis of samples.</p> <p>Third-party data validation will be performed on all samples, except waste characterization samples.</p> <p>Sampling and analysis protocols will be carefully followed to limit errors.</p> <p>Confirmation samples will be collected at the interval specified in the San Diego SAM Manual 2005.</p> <p>Sample collection and</p>	<p>Confirmation soil samples will be collected along each sidewall (at a frequency of one every 20 linear feet) and one from the bottom to assess the removal of contamination.</p> <p>Groundwater samples will be collected from three new wells.</p> <p>Backfill samples will be collected and analyzed in accordance with the DTSC guidance.</p>

TABLE A.8-1
SUMMARY OF DATA QUALITY OBJECTIVES

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7
Statement of Problem	Decisions	Inputs to the Decisions	Boundaries of the Study	Decision Rules	Limits on Decision Errors	Optimize the Sampling Design
				<p>will be prepared.</p> <p>(3) (a) If backfill samples contain contaminants above action levels listed in Table A.8-2, then another source will be sampled.</p> <p>(3) (b) If backfill samples contain contaminants below action levels, then the soil will be used for backfill material.</p>	<p>analysis methods were chosen to minimize sampling errors.</p> <p>Backfill samples will be collected and analyzed in accordance with DTSC Information Advisory Clean Imported Fill Material (DTSC, 2001).</p>	

Notes:

DQO – data quality objective
DTSC – Department of Toxic Substances Control
PAH – polynuclear aromatic hydrocarbon
SAM – Site Assessment and Mitigation Manual
SAP – Sampling and Analysis Plan

SPLP – Synthetic Precipitation Leaching Procedure
TPH-d – total petroleum hydrocarbons quantified as diesel
UST – Underground Storage Tank
VOC – volatile organic compound
WQO – Water Quality Objective

TABLE A.8-2

PROPOSED REPORTING LIMITS

Method	Analyte	Soil		Action Level		
		RL	Unit	Confirmation Soil Samples ¹	Backfill Material Samples ²	Stockpile Samples ³
TPH-d EPA Method 3550B/8015B	Diesel (C ₁₀ –C ₂₄)	10	mg/kg	N/A	N/A	NE
VOCs EPA Method 5035/8260B	1,1,1-Trichloroethane	5	µg/kg	N/A	N/A	NE
	1,1,2,2-Tetrachloroethane	5	µg/kg	N/A	N/A	NE
	1,1,2-Trichloroethane	5	µg/kg	N/A	N/A	NE
	1,1-Dichloroethane	5	µg/kg	N/A	N/A	NE
	1,1-Dichloroethene	5	µg/kg	N/A	N/A	NE
	1,2-Dichloroethane	5	µg/kg	N/A	N/A	NE
	1,2-Dichloropropane	5	µg/kg	N/A	N/A	NE
	2-Hexanone	50	µg/kg	N/A	N/A	NE
	Acetone	50	µg/kg	N/A	N/A	NE
	Benzene	5	µg/kg	N/A	N/A	NE
	Bromodichloromethane	5	µg/kg	N/A	N/A	NE
	Bromoform	5	µg/kg	N/A	N/A	NE
	Bromomethane	5	µg/kg	N/A	N/A	NE
	Carbon tetrachloride	5	µg/kg	N/A	N/A	NE
	Chlorobenzene	5	µg/kg	N/A	N/A	NE
	Chloroethane	5	µg/kg	N/A	N/A	NE
	Chloroform	5	µg/kg	N/A	N/A	NE
	Chloromethane	5	µg/kg	N/A	N/A	NE
	cis-1,2-Dichloroethene	5	µg/kg	N/A	N/A	NE
	cis-1,3-Dichloropropene	5	µg/kg	N/A	N/A	NE
	Dibromochloromethane	5	µg/kg	N/A	N/A	NE
	Di-isopropyl ether	5	µg/kg	N/A	N/A	NE
	Ethylbenzene	5	µg/kg	N/A	N/A	NE
	Ethyl tert-butyl ether	5	µg/kg	N/A	N/A	NE
	Methyl ethyl ketone	50	µg/kg	N/A	N/A	NE
	Methyl tert-butyl ether	10	µg/kg	N/A	N/A	NE
	Methylene chloride	5	µg/kg	N/A	N/A	NE
	Methyl isobutyl ketone	50	µg/kg	N/A	N/A	NE
	Styrene	5	µg/kg	N/A	N/A	NE
	Tert-amyl methyl ether	5	µg/kg	N/A	N/A	NE
	Tert-butyl alcohol	50	µg/kg	N/A	N/A	NE
	Tetrachloroethene	5	µg/kg	N/A	N/A	NE
	Toluene	5	µg/kg	N/A	N/A	NE
	trans-1,2-Dichloroethene	5	µg/kg	N/A	N/A	NE
	trans-1,3-Dichloropropene	5	µg/kg	N/A	N/A	NE

TABLE A.8-2

PROPOSED REPORTING LIMITS

Method	Analyte	Soil		Action Level		
		RL	Unit	Confirmation Soil Samples ¹	Backfill Material Samples ²	Stockpile Samples ³
	Trichloroethene	5	µg/kg	N/A	N/A	2,040,000
	Vinyl acetate	50	µg/kg	N/A	N/A	NE
	Vinyl chloride	5	µg/kg	N/A	N/A	NE
	Xylenes (Total)	15	µg/kg	N/A	N/A	NE
PAHs by EPA Method 3550B/8270C SIM or 3550B/8310	Acenaphthene	17	µg/kg	N/A	N/A	NE
	Acenaphthylene	17	µg/kg	N/A	N/A	NE
	Anthracene	17	µg/kg	N/A	N/A	NE
	Benzo[a]anthracene	17	µg/kg	N/A	N/A	NE
	Benzo[a]pyrene	17	µg/kg	N/A	N/A	NE
	Benzo[b]fluoranthene	17	µg/kg	N/A	N/A	NE
	Benzo[g,h,i]perylene	17	µg/kg	N/A	N/A	NE
	Benzo[k]fluoranthene	17	µg/kg	N/A	N/A	NE
	Chrysene	17	µg/kg	N/A	N/A	NE
	Dibenzo[a,h]anthracene	17	µg/kg	N/A	N/A	NE
	Fluoranthene	17	µg/kg	N/A	N/A	NE
	Fluorene	17	µg/kg	N/A	N/A	NE
	Indeno[1,2,3-cd]pyrene	17	µg/kg	N/A	N/A	NE
	Naphthalene	17	µg/kg	N/A	N/A	NE
	Phenanthrene	17	µg/kg	N/A	N/A	NE
	Pyrene	17	µg/kg	N/A	N/A	NE
Title 22 Metals by EPA Methods 3050B/6010B/7471A (For Backfill Material Analysis)	Antimony	10	mg/kg	NA	820	500
	Arsenic	1	mg/kg	NA	4.6	500
	Barium	1	mg/kg	NA	100,000	10,000
	Beryllium	1	mg/kg	NA	2,200	75
	Cadmium	1	mg/kg	NA	810	100
	Chromium, total	1	mg/kg	NA	450	2,500
	Cobalt	1	mg/kg	NA	100,000	8,000
	Copper	1	mg/kg	NA	76,000	2,500
	Lead	1	mg/kg	NA	750	1,000
	Mercury	0.1	mg/kg	NA	610	20
	Molybdenum	5	mg/kg	NA	10,000	3,500
	Nickel	2	mg/kg	NA	41,000	2,000
	Selenium	1	mg/kg	NA	10,000	100
	Silver	1	mg/kg	NA	10,000	500
	Thallium	1	mg/kg	NA	130	700
	Vanadium	1	mg/kg	NA	14,000	2,400
	Zinc	1	mg/kg	NA	100,000	5,000

TABLE A.8-2

PROPOSED REPORTING LIMITS

Parameter/Method	Analyte	Water ⁴		Action Levels		
		RL	Unit	Groundwater Samples ⁵	Wastewater Sampling ⁶	
					STLC Limit	TCLP Limit
TPH-d by EPA Method 3520C/8015B or SPLP/TPH-d by EPA Method 1312/8015B	Diesel (C ₁₀ –C ₂₄)	0.1	mg/L	0.1 ⁷	NE	NE
VOCs by EPA Method 5030B/8260B or SPLP/VOCs by EPA Method 1312/8260B	1,1,1-Trichloroethane	5	µg/L	200	NE	NE
	1,1,2,2-Tetrachloroethane	1	µg/L	1	NE	NE
	1,1,2-Trichloroethane	5	µg/L	5	NE	NE
	1,1-Dichloroethane	5	µg/L	5	NE	NE
	1,1-Dichloroethene	5	µg/L	6	NE	700
	1,2-Dichloroethane	0.5	µg/L	0.5	NE	500
	1,2-Dichloropropane	5	µg/L	5	NE	NE
	2-Hexanone	50	µg/L	NE	NE	NE
	Acetone	50	µg/L	NE	NE	NE
	Benzene	0.5	µg/L	1	NE	500
	Bromodichloromethane	5	µg/L	100	NE	NE
	Bromoform	5	µg/L	100	NE	NE
	Bromomethane	5	µg/L	NE	NE	NE
	Carbon tetrachloride	0.5	µg/L	0.5	NE	500
	Chlorobenzene	5	µg/L	30	NE	100,000
	Chloroethane	5	µg/L	NE	NE	NE
	Chloroform	5	µg/L	100	NE	6,000
	Chloromethane	5	µg/L	NE	NE	NE
	cis-1,2-Dichloroethene	5	µg/L	NE	NE	NE
	cis-1,3-Dichloropropene	0.5	µg/L	0.5	NE	NE
	Dibromochloromethane	5	µg/L	100	NE	NE
	Di-isopropyl ether	5	µg/L	NE	NE	NE
	Ethylbenzene	0.5	µg/L	680	NE	NE
	Ethyl tert-butyl ether	5	µg/L	NE	NE	NE
	Methyl ethyl ketone	50	µg/L	NE	NE	200,000
	Methyl tert-butyl ether	1	µg/L	13	NE	NE
	Methylene chloride	5	µg/L	NE	NE	NE
	Methyl isobutyl ketone	50	µg/L	NE	NE	NE
	Styrene	5	µg/L	NE	NE	NE
	Tert-amyl methyl ether	5	µg/L	NE	NE	NE
	Tert-butyl alcohol	20	µg/L	NE	NE	NE
	Tetrachloroethene	5	µg/L	5	NE	700
	Toluene	0.5	µg/L	150	NE	NE
	trans-1,2-Dichloroethene	5	µg/L	10	NE	NE

TABLE A.8-2

PROPOSED REPORTING LIMITS

Parameter/Method	Analyte	Water ⁴		Action Levels		
		RL	Unit	Groundwater Samples ⁵	Wastewater Sampling ⁶	
					STLC Limit	TCLP Limit
	trans-1,3-Dichloropropene	0.5	µg/L	NE	NE	NE
	Trichloroethene	5	µg/L	5	204,000	500
	Vinyl acetate	50	µg/L	NE	NE	NE
	Vinyl chloride	0.5	µg/L	0.5	NE	200
	Xylenes (Total)	5	µg/L	1,750	NE	NE
PAHs by EPA Method 3520C/8270C SIM or 3520C/8310 or SPLP/PAHs by EPA Method 1312/8270C SIM or 1312/8310	Acenaphthene	1	µg/L	NE	NE	NE
	Acenaphthylene	1	µg/L	NE	NE	NE
	Anthracene	2	µg/L	NE	NE	NE
	Benzo[a]anthracene	2	µg/L	NE	NE	NE
	Benzo[a]pyrene	0.2	µg/L	0.2	NE	NE
	Benzo[b]fluoranthene	1	µg/L	NE	NE	NE
	Benzo[g,h,i]perylene	1	µg/L	NE	NE	NE
	Benzo[k]fluoranthene	2	µg/L	NE	NE	NE
	Chrysene	2	µg/L	NE	NE	NE
	Dibenz[a,h]anthracene	1	µg/L	NE	NE	NE
	Fluoranthene	2	µg/L	NE	NE	NE
	Fluorene	2	µg/L	NE	NE	NE
	Indeno[1,2,3-cd]pyrene	1	µg/L	NE	NE	NE
	Naphthalene	1	µg/L	NE	NE	NE
	Phenanthrene	1	µg/L	1	NE	NE
	Pyrene	2	µg/L	NE	NE	NE
Anions by EPA Method 300.0	Nitrate	0.1	mg/L	NE	NE	NE
	Sulfate	0.5	mg/L	NE	N/A	N/A

Notes:

¹– Action levels for confirmation soil samples are not applicable. SPLP analysis will be performed on soil samples, and therefore the WQOs listed under groundwater sample action levels will be used.

²–Action levels for backfill analysis are based on Preliminary Remediation Goals (PRGs) for Industrial Soil (EPA, Region 9, 2004) except for arsenic, which is based on *Remedial Investigation/Feasibility Study Background Study for the MCB, Camp Pendleton, California* (SWDIV, 1997).

³–Action levels listed for stockpile samples are based on California Title 22 Total Threshold Limit Concentrations (TTLCs).

⁴– Water reporting limits will apply to groundwater samples, equipment rinsate samples, wastewater samples, and SPLP analysis.

⁵– Action levels are based on California Drinking Water Standards, Maximum Contaminant Levels (MCLs), or the *Water Quality Control Plan for the San Diego County Basin Plan* [Regional Water Quality Control Board (RWQCB), 1994]. These action levels will be used for soil confirmation SPLP results and for the groundwater results.

⁶– Action levels for wastewater samples are based on California Title 22 STLC and TCLP limits.

⁷– Secondary taste and odor threshold.

TABLE A.8-2**PROPOSED REPORTING LIMITS**

µg/kg	–	micrograms per kilogram	RL	–	reporting limit
µg/L	–	micrograms per liter	SIM	–	Selective Ion Monitoring
EPA	–	U.S. Environmental Protection Agency	SPLP	–	Synthetic Precipitation Leaching Procedure
mg/kg	–	milligrams per kilogram	STLC	–	Soluble Threshold Limit Concentration
mg/L	–	milligrams per liter	TCLP	–	Toxicity Characteristic Leaching Procedure
NE	–	not established	TPH-d	–	total petroleum hydrocarbon quantified as diesel
PAH	–	polynuclear aromatic hydrocarbons	VOC	–	volatile organic compound

TABLE A.8-3
QUALITY CONTROL ACCEPTANCE CRITERIA

Method	Analyte	Accuracy Water (%R)	Precision Water (RPD)	Accuracy Soil (%R)	Precision Soil (RPD)
TPH-d EPA Method 8015B	Diesel	65-135	≤ 30	65-135	≤ 35
	<i>Surrogate:</i> Hexacosane, Octacosane or Bromobenzene	65-135	N/A	65-135	N/A
VOCs EPA Method 8260B	1,1-Dichloroethene	75-125	≤ 20	65-135	≤ 30
	Benzene	75-125	≤ 20	65-135	≤ 30
	Chlorobenzene	75-125	≤ 20	65-135	≤ 30
	Trichloroethene	75-125	≤ 20	65-135	≤ 30
	Toluene	75-125	≤ 20	65-135	≤ 30
	<i>Surrogates*:</i> Dibromofluoromethane	75-125	N/A	60-140	N/A
	Toluene-d ₈	75-125	N/A	65-135	N/A
	4-Bromofluorobenzene	75-125	N/A	65-135	N/A
	1,2-Dichloroethane-d ₄	65-135	N/A	60-140	N/A
PAHs EPA Method 8270C SIM or 8310	Acenaphthene	40-130	≤ 30	40-130	≤ 50
	Acenaphthylene	40-130	≤ 30	40-130	≤ 50
	Anthracene	50-130	≤ 30	50-130	≤ 50
	Benzo[a]anthracene	50-130	≤ 30	50-130	≤ 50
	Benzo[a]pyrene	50-130	≤ 30	50-130	≤ 50
	Benzo[b]fluoranthene	50-130	≤ 30	50-130	≤ 50
	Benzo[g,h,i]perylene	50-130	≤ 30	50-130	≤ 50
	Benzo[k]fluoranthene	30-150	≤ 30	50-130	≤ 50
	Chrysene	50-130	≤ 30	50-130	≤ 50
	Dibenzo[a,h]anthracene	40-140	≤ 30	50-130	≤ 50
	Fluoranthene	50-130	≤ 30	50-130	≤ 50
	Fluorene	40-130	≤ 30	50-130	≤ 50
	Indeno[1,2,3-c,d]pyrene	30-140	≤ 30	50-130	≤ 50
	Naphthalene	30-130	≤ 30	40-130	≤ 50
	Phenanthrene	40-130	≤ 30	50-130	≤ 50
	Pyrene	40-130	≤ 30	40-130	≤ 50
	<i>Surrogate:</i> p-Terphenyl-d ₁₄	50-130	N/A	50-130	N/A

TABLE A.8-3
QUALITY CONTROL ACCEPTANCE CRITERIA

Method	Analyte	Accuracy Water (%R)	Precision Water (RPD)	Accuracy Soil (%R)	Precision Soil (RPD)
Title 22 Metals EPA Methods 6010B/ 7470A/7471A	Antimony	75-125	≤ 20	75-125	≤ 25
	Arsenic	75-125	≤ 20	75-125	≤ 25
	Barium	75-125	≤ 20	75-125	≤ 25
	Beryllium	75-125	≤ 20	75-125	≤ 25
	Cadmium	75-125	≤ 20	75-125	≤ 25
	Chromium, total	75-125	≤ 20	75-125	≤ 25
	Cobalt	75-125	≤ 20	75-125	≤ 25
	Copper	75-125	≤ 20	75-125	≤ 25
	Lead	75-125	≤ 20	75-125	≤ 25
	Mercury	75-125	≤ 20	75-125	≤ 25
	Molybdenum	75-125	≤ 20	75-125	≤ 25
	Nickel	75-125	≤ 20	75-125	≤ 25
	Selenium	75-125	≤ 20	75-125	≤ 25
	Silver	75-125	≤ 20	75-125	≤ 25
	Thallium	75-125	≤ 20	75-125	≤ 25
	Vanadium	75-125	≤ 20	75-125	≤ 25
	Zinc	75-125	≤ 20	75-125	≤ 25
Anions	Nitrate	80-120	≤ 20	N/A	N/A
EPA Method 300.0	Sulfate	80-120	≤ 20	N/A	N/A

Notes:

- %R – percent recovery
- EPA – U.S. Environmental Protection Agency
- N/A – not applicable
- PAH – polynuclear aromatic hydrocarbon
- RPD – relative percent difference
- SIM – Selective Ion Monitoring
- TPH-d – total petroleum hydrocarbons quantified as diesel
- VOC – volatile organic compound
- * – only three surrogates are required

FIGURES

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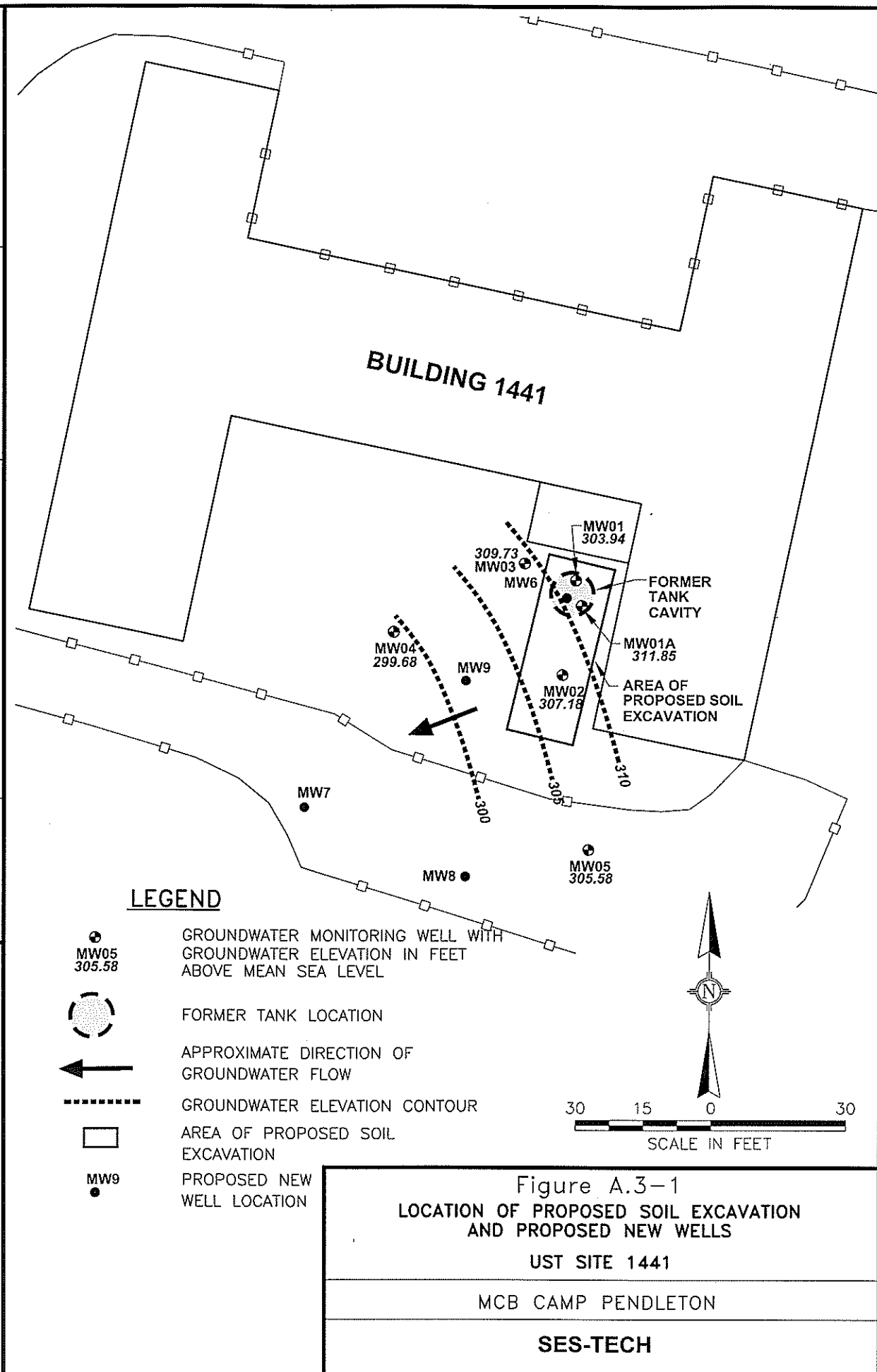


Figure A.7-1
Project Organization Chart

